GUIDE

TO THE

WHALES, PORPOISES,

AND

DOLPHINS

(ORDER CETACEA),

EXHIBITED IN

THE DEPARTMENT OF ZOOLOGY,

BRITISH MUSEUM (NATURAL HISTORY),

CROMWELL ROAD, LONDON, S.W.

ILLUSTRATED BY 33 FIGURES.

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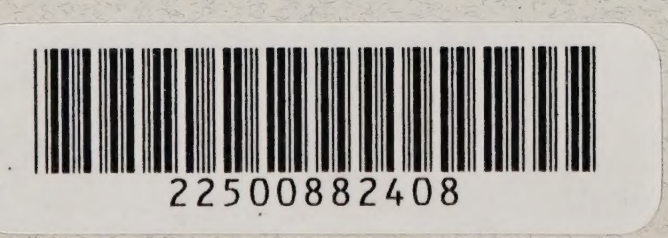
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PREFACE.

Although the idea was long prevalent among the uninstructed that the Cetacea are fishes, these animals are really Mammals, adapted for a purely aquatic existence; and on this account, as well as from the gigantic size of many of their representatives, they form a group of more than ordinary interest.

The proper exhibition of the members of the Cetacea in a public museum is a matter of very great difficulty, not only because of the amount of space required by the larger species, but likewise owing to the difficulty of preparing and mounting the skins. A specimen may, after very careful preparation, look fairly well when first placed on exhibition; but after a time the oil with which the skin is saturated is almost certain to exude at the surface and to render the specimen unsightly.

Under these circumstances it has been found advisable to employ, for the most part, only skeletons and models for exhibition purposes. The idea of constructing half-models in plaster on one side of the skeletons of the larger species was introduced into the Museum by Sir W. H. Flower, when Director; and the present Whale-room was built and installed under his personal supervision. At the time when it was first opened it was practically, if not entirely, a unique exhibition; and it has ever since been a source of great interest and attraction to the public.

In a perfectly arranged museum the Whale-room should be in immediate connexion with the other Mammal Galleries, but in the building as now arranged this was found to be impracticable.

The present Guide-book has been drawn up by Mr. R. Lydekker.

SIDNEY F. HARMER,
Keeper of Zoology.

British Museum (Natural History),
London.
March, 1909.

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GUIDE TO WHALES, PORPOISES, AND DOLPHINS (ORDER CETACEA).

Whales, Porpoises, and Dolphins form a large group of Mammals specially modified for the needs of an aquatic existence, having no external traces of hind-limbs, the fore-limbs in the form of paddles, the tail expanded into a horizontal fin, or "flukes," and the nostrils situated on the top of the head, generally remote from the muzzle, and opening by a single or double "blow-hole." Although some of the Dolphins frequently ascend tidal rivers, while a few are exclusively fluviatile, the majority of Cetaceans are inhabitants of the open sea, and all subsist on animal substances. Existing Cetacea may be divided into two suborders, namely, the Wha'ebone Whales, or Mystacoceti, in which functional teeth are wanting and the upper jaw is furnished with whalebone or "baleen"; and the Toothed Whales, or Odontoceti, in which teeth are present, although these may be reduced to a single pair in the lower jaw. Whales and Dolphins appear to be derived from primitive Carnivorous Mammals, as the extinct Zeuglodonts certainly have such an origin, and there is a strong probability that they are related to the ancestors of the existing Cetacea. The order includes the largest of all living animals.

Characteristics of Whales.

In accordance with their fish-like mode of life, the body of Whales and Dolphins is spindle-shaped, the head passing imperceptibly into the trunk without the intervention of a distinct neck, while posteriorly the trunk gradually tapers towards the extremity of the tail, which is expanded into the aforesaid horizontal flukes, which forms a triangular propelling instrument, deeply notched on its hind border.

In most members of the order, but more especially in the true Whales, the head is large in proportion to the body, attaining in some species of the latter more than one-third the entire length of the animal; and the mouth is always wide, and bounded by stiff immobile lips. The fore-limbs are reduced to the condition of flattened flippers, or paddles, encased in skin, showing no external sign of division into arm, fore-arm, hand, or separate fingers, and without any trace of nails. No signs of hind-limbs are externally visible. The general surface of the skin is smooth, glistening, and devoid of hair, although in most species there are a few fine bristles in the neighbourhood of the mouth, which may either remain throughout life, or are found only in the young state. Certain other species, notably the Indian Porpoise, have minute scales embedded in the skin of part of the back; and these suggest that Whales are derived from animals furnished with a complete bony armour. Immediately beneath the skin is a thick layer of fat, held together by a mesh of fibrous tissue, constituting the "blubber," which serves the purpose of the hairy coat of other Mammals in retaining the heat of the body. In most species there is a fin, more or less triangular in shape and composed only of skin and fibrous tissue, situated near the middle of the back, which may aid in maintaining the position of the animal in the water. The eye is small; and the aperture of the ear minute, and without any vestige of a conch. The nostrils, or "blow-holes," open separately, or by a single valve-like aperture, placed (except in the Sperm-Whale) near the top of the head.

The bones are generally spongy in texture, their cavities being filled with oil. In the back-bone the region of the neck is remarkably short and incapable of motion, and the vertebræ, seven in number, as in other Mammals, are in many species more or less completely fused into a solid mass. None of the hinder vertebræ of the body are united together to form a "sacrum," or to join the pelvis. The vertebræ of the loins and tail are numerous, large, and capable of free motion; and very frequently vary in number in different individuals of the same species. Beneath the latter are large V-shaped "chevron-bones" which project downwards, and give increased surface for the attachment of the muscles which move the tail; but there are no bones supporting the lateral "flukes" of the tail or the back-fin. It has been suggested that the flukes are formed in part by remnants

of the hind-limbs, but there is no evidence that this is really the case.

The skull is modified in a peculiar manner; the brain-case being short, high, and broad, and, in fact, almost spherical. The nostrils open upwards, immediately in front of the brain-case, and before them is a more or less horizontally prolonged beak, extending forwards to form the upper jaw or roof of the mouth. Other particulars in regard to the structure of the skull are given under the heading of the Pilot-Whale (p. 37). There are no collar-bones (clavicles). The upper arm-bone, or humerus, is freely movable on the blade-bone, or scapula, at the shoulder-joint; but beyond this the articulations of the limb are imperfect, flattened ends of the bones coming in contact with each other, with fibrous tissue interposed, allowing scarcely any motion. The two bones of the fore-arm (radius and ulna) are distinct and much flattened, as are also the bones of the hand. There are usually five fingers in the skeleton, though sometimes the first, corresponding to the thumb, is wanting. The pelvis, or hip-bone, is represented merely by a pair of elongated slender bones, suspended below, and at some distance from, the vertebral column, in the region of the loins; and to the outer side of these, in some Whales, are attached small bones representing the bones of the limb proper. Thus the exhibited skeleton of the Common Rorqual shows a little nodule of bone, scarcely larger than a walnut, which is the rudiment of the thigh-bone, or femur, and is the only trace of a hind-limb this gigantic animal possesses.

Cetaceans abound in all seas, and some Dolphins are inhabitants of the larger rivers of South America and Southern Asia. They pass their life entirely in the water, as on land they are absolutely helpless; whether they sleep is unknown. They have to rise frequently to the surface in order to breathe; and, in relation to the constant upward and downward movement in the water thus necessitated, the tail, unlike that of a Fish, whose movements are mainly in straightforward or lateral directions, is expanded horizontally. The position of the nostrils on the highest part of the head is important for this mode of life, as it is the only part of the body the exposure of which above the surface is necessary. The "spouting," or "blowing," of Whales is the ordinary act of breathing, performed at longer intervals than in land-animals. The moment a Whale rises to the surface it forcibly expels from its lungs the air taken in at the last inspiration, which is heated

and charged with water-vapour. This, condensing in a cold atmosphere, forms a column of steam or spray; but when the animal commences to "blow" before the nostril has cleared the top of the water, some of the latter is often driven upwards with the blast. In hunting Whales the harpoon often pierces the lungs or air-passages, when fountains of blood are forced high in the air through the blow-holes.

Whales and Dolphins prey upon living animal food; but the Killers alone eat other warm-blooded animals, as Seals, and even members of their own kind, large and small. Many feed on fish, others on small floating crustaceans, minute molluscs, and jelly-fish; while the principal food of many is constituted by various species of cuttlefishes, especially squid, which abound in some seas, where they form almost the entire support of some of the largest members of the order, such as the Sperm-Whale.

In size the members of the order vary immensely, some of the smaller Dolphins scarcely exceeding four feet in length, while Whales excel in bulk any animal of either present or past times of which we have any evidence.

With a few exceptions, Whales and Dolphins are timid, inoffensive creatures, active in their movements, and affectionate in disposition towards one another. This is especially the case with regard to the conduct of the mother towards her young, of which there is usually one, and at most two, at a time. They are generally gregarious, swimming in herds, or "schools," sometimes amounting to hundreds in number, though some species are met with singly or in pairs.

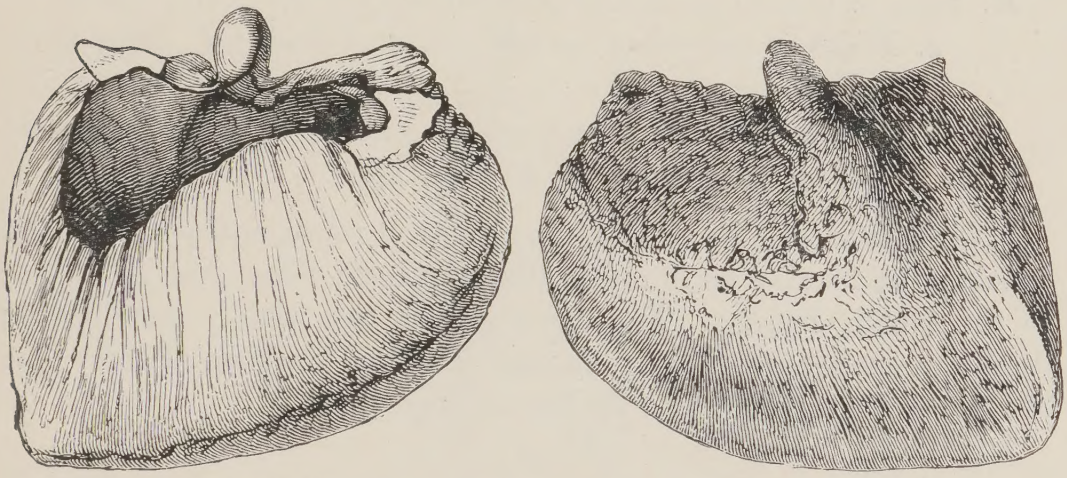
Like Fishes, many Dolphins and Porpoises, which habitually swim near the surface of the water, have their backs dark and their under-parts light, thus rendering them as inconspicuous as possible, both when seen from above and from below.

Ear-Bones. In this place reference may conveniently be made to the ear-bones of Cetaceans, of which a series is exhibited in one of the table-cases at the north end of the gallery. These are not to be confounded with the bones (stapes, incus, and malleus) commonly called ear-bones in Man and other land-Mammals. They really represent the tympanic and periotic of the human skull, the former of which constitutes the bony tube of the ear, while the latter encloses the little bones of the inner portion of the organ of hearing. In Whales the

tympanic (fig. 1) forms an inflated shell-like bone, and thus corresponds to the bladder-like tympanic, or auditory bulla occurring in many Carnivora. Each genus of Cetaceans has a characteristic type of both tympanic and periotic (fig. 11), as is indicated by the specimens exhibited. It is often convenient to speak of the combined bones as tympano-petrosal.

Whalebone-Whales. The most obvious distinctive characteristic of the Whalebone-Whales (constituting the suborder Mystacoceti) is that the palate is provided with plates of the horny substance called whalebone, or "baleen," which act as a sieve to separate the food from the water taken at the same

Fig. 1.



Two Views of the Right Tympanic Bone of the Greenland Whale (*Balæna mysticetus*), to show the angulated form characteristic of the Right-Whales generally. Half natural size.

time into the mouth. Although rudiments of teeth are present in the early stages of existence, they always disappear, and are never of use. The external openings of the nostrils are distinct from each other and in the form of longitudinal slits. These Whales differ from the Odontoceti in many osteological characters, such as the breast-bone, or sternum, being composed of one piece, and articulating with a single pair of ribs; in the two branches of the lower jaw arching outwards and their anterior ends meeting at an angle, without any bony union; and in the skull being symmetrical, with the nasal bones forming a roof to the nasal passages.

All the Whalebone-Whales may be included in the single

family, *Balænidæ*, and are divided into five genera, the most striking distinguishing characters of which are as follows:—

A. Skin of the throat smooth.

a. Whalebone long, slender and elastic: all the neck, or cervical, vertebræ united together.

(*a*) No back-fin; flippers broad (five-fingered): *Balæna*, Right-Whales.

(*b*) A small, falcate (sickle-shaped) back-fin; flipper narrow (four-fingered): *Neobalæna*, Pigmy Whale.

b. Whalebone very short and coarse: vertebræ of the neck free: no back-fin: *Rhachianectes*, Grey Whale.

B. Skin of the throat furrowed: whalebone short and coarse.

a. Flippers very long: a low, rounded back-fin: *Megaptera*, Hump-back Whale.

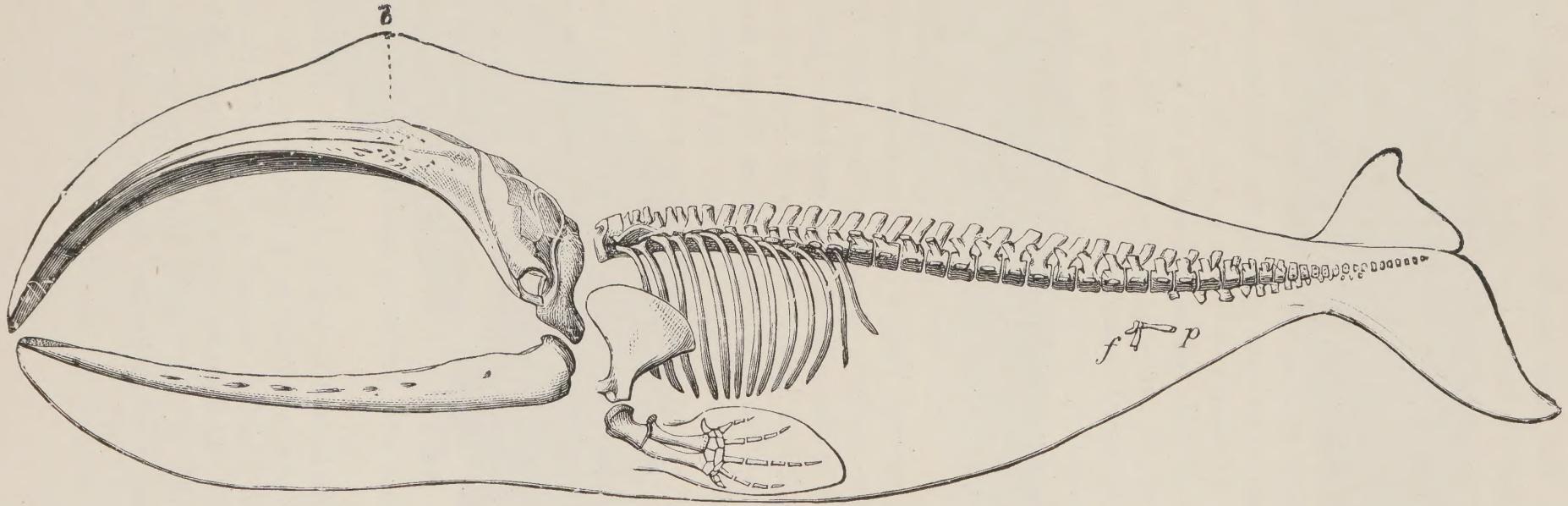
b. Flippers small: a triangular, falcate back-fin: *Balænoptera*, Rorquals or Fin-Whales.

Neobalæna and *Rhachianectes* are each represented by a single species, the former confined to the Southern Seas and the latter to the North Pacific. The other genera are widely distributed; there are certainly two very distinct kinds of *Balæna*, at least four of *Balænoptera*, perhaps only one of *Megaptera*.

Right-Whales. These Whales (genus *Balæna*) are distinguished from other Whalebone-Whales by the disproportionately large size, and especially the great height, of the head, as well as by the absence of a back-fin, and of furrows in the skin of the throat. Notwithstanding their enormous bulk, they appear not to exceed about fifty feet in length. The comparative facility with which they are caught, the length and fine quality of their whalebone, and the great quantity of oil they yield have given rise to the name by which they are usually designated by whalers, in contradistinction to Rorquals and other less valuable species. They feed upon very minute crustaceans and pteropods, which swarm in immense shoals in the seas they frequent; specimens of such "Whale-food" are exhibited in glass jars on the east wall of the Whale-room. The females are larger than the males.

There are two very distinct types of Right-Whale. Firstly, the Greenland or Arctic Right-Whale (*Balæna mysticetus*, fig. 2) of the

FIG. 2.



The Greenland Right-Whale (*Balæna mysticetus*).

Skeleton and outline: *b*, position of nostrils or blow-holes; *p*, pelvic or hip-bone; *f*, rudimentary femur or thigh-bone.

About $\frac{1}{100}$ natural size.

North Polar Seas. The great size the head of this species may attain is shown by the pair of lower jaws and the blades of whalebone exhibited. The "fishery" of this Whale in the Greenland and Spitsbergen Seas was, during the last two centuries, of great commercial importance, but is now of very limited extent, owing to the scarcity of the species. Secondly, we have the Black Right-Whales (fig. 3), distinguished by the smaller head, shorter whalebone, and the greater number of ribs and vertebræ. They are inhabitants of the temperate seas of both the Northern and Southern Hemispheres, but do not occur in the equatorial seas. They have been divided into several species, according to their geographical distribution, namely, *B. australis*, of the South Atlantic, *B. glacialis* or *biscayensis*, of the North Atlantic, *B. antipodarum*, of the South Pacific, and *B. japonica*, of the North Pacific; but these may perhaps be preferably regarded as local races of a single widespread species.

The angulated form of the tympanic bone of the Right-Whales is shown in fig. 1.

In addition to several blades of whalebone exhibited on the western wall of the gallery, the Greenland Right-Whale is at present represented in the collection by the lower jaw-bones of a very large female killed in the Greenland Seas, lat. 73° 40 N., long. 16° 0 W., on the 21st June, 1887. This Whale was one of the largest Captain David Gray ever met with, and yielded 26 tons of oil, and 26 cwt. of whalebone. The jaw was presented by Captain Gray, of the s.s. "Eclipse," in 1887.

The external form and colouring of the Greenland Right-Whale are shown by a miniature model, on the scale of one inch to one foot, made from a specimen taken on June 17th, 1878, in 80° N. lat., Greenland Seas, and presented to the Museum by Captain David Gray in 1885. The presence of a considerable amount of white on the lower jaw and at the root of the tail is a characteristic feature of the species, and serves to distinguish it from the Black Whales.

Attention may be here directed to a piece of whalebone of the Greenland Right-Whale exhibited in a table-case at the north end of the gallery, upon which is incised a sketch of a Sperm-Whale-hunt in the Adriatic. The sketch shows the truncated form of the muzzle characteristic of the adult male Sperm-Whale. This interesting specimen was presented by Dr. J. W. Burbidge in 1903.

FIG. 3.

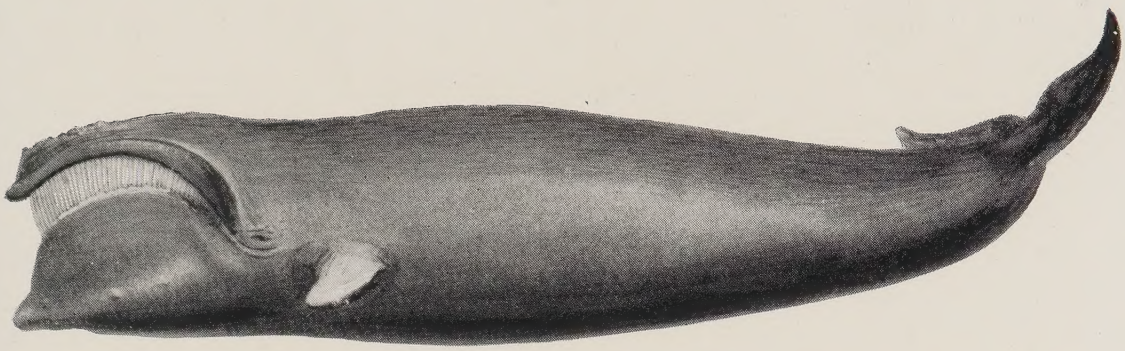


FIG. 4.

FIG. 5.

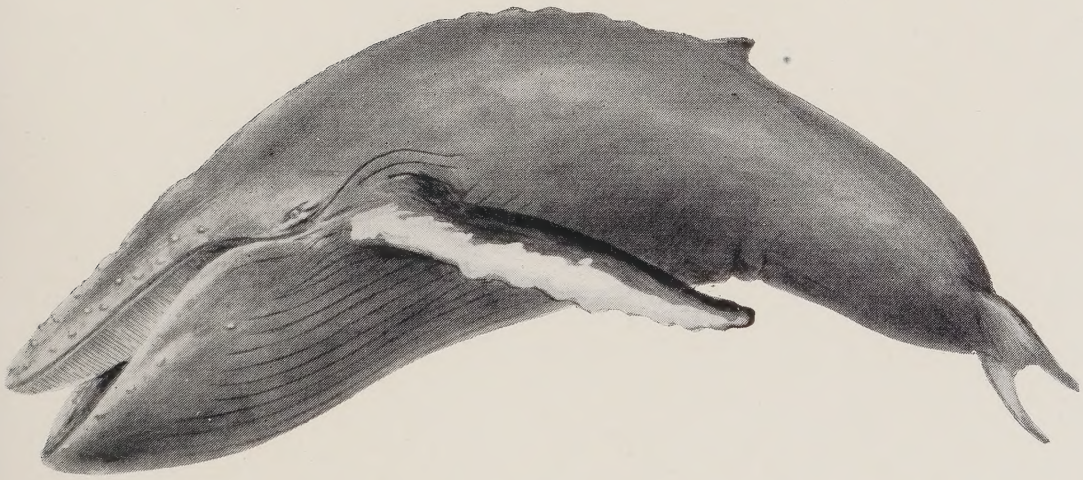


FIG. 3. The North Atlantic Black Right-Whale (*Balæna glacialis*).
FIG. 4. The Blue Rorqual (*Balænoptera sibbaldi*).
FIG. 5. The Humpback Whale (*Megaptera boöps*).

Fig. 3 about $\frac{1}{127}$, Fig. 4 $\frac{1}{195}$, Fig. 5 $\frac{1}{195}$ natural size.

From models presented by the U.S. National Museum.

[*To face page* 14.

To the western wall of the building are affixed several blades of the whalebone of the Greenland Right-Whale obtained from the Greenland Seas, and described and figured in Dr. J. E. Gray's "Zoology of the 'Erebus' and 'Terror'" (1846). The specimens were presented to the Museum by Messrs. Smith and Simmonds.

The North Atlantic Black Right-Whale (*Balæna glacialis*, or *B. biscayensis*), the Nordkaper of the Dutch, the Sarde of the Icelandic, and the Sletbag of the old French whalers, is, as already mentioned, closely allied to, if not specifically identical with, the Black, or Southern, Right-Whale. The northern limit of the range of this Whale is almost exactly conterminous with the southern limit of that of the Greenland Right-Whale. The North Atlantic, or Biscay, Right-Whale (fig. 3) has a much smaller head and more arched lower jaw than the Greenland species; while the surface of the upper jaw is roughened, and often has a horny hump known as the "bonnet." It is further characterised by the frequent presence upon its skin of parasitic barnacles (*Coronula*), which are never found on the Greenland Whale. This Whale is represented in the Gallery by the complete skeleton, upon which a half-model is built, of an adult male, forty-nine feet in length, taken off the north-west coast of Iceland in the summer of 1891; and also by a miniature model of the entire animal presented by the American Museum of Natural History in 1908. The wholly black colour of the skin should be noticed.

In a table-case near by are exhibited two specimens of the above-mentioned horny excrescence from the fore part of the head of the North Pacific Black Right-Whale, termed by whalers the "bonnet." Such horny growths appear to be commonly developed in all the Black Whales; and are tenanted by numbers of parasitic crustaceans. The larger of the two specimens was obtained from the North Pacific, and presented by Mr. E. W. H. Holdsworth in 1864. There is likewise a small specimen of the "bonnet" of the Southern Black Right-Whale (*Balæna australis*), from the Sandwich Islands, also presented by Mr. Holdsworth in 1864.

To emphasize the fact that in the genus *Balæna* the neck is very short, and the seven vertebræ are all welded together, there is exhibited a set of the seven cervical vertebræ of the North Atlantic Black Right-Whale. This specimen was dredged off Bridport, Dorsetshire, and presented by the Rev. H. Beecham in 1853.

Near by is shown a partially fossilised imperfect skull of the Southern Black Right-Whale (*Balæna australis*), obtained from a superficial formation, two hundred miles from the sea, at Villa Constitucion, Rio Parana, Argentina, and presented to the Museum by Mr. H. C. Gostling in 1898.

On the western wall of the building are exhibited several blades of the whalebone of the Southern Right-Whale. These specimens came from the South Seas, and are described and figured in Dr. J. E. Gray's "Zoology of the 'Erebus' and 'Terror'" (1846). They were presented by Messrs. Smith and Simmonds.

Pigmy Whale. This little Whale (*Neobalæna marginata*), the only representative of its genus, is confined to the southern seas, and is in many respects allied to the Right-Whales, which it resembles in the absence of pleats on the throat and in the fusion of the cervical vertebræ, although it approximates to the Rorquals in the presence of a fin on the back. The long, slender, and elastic whalebone is white in colour. There are only four digits to each flipper. This Whale attains an approximate length of 20 feet, of which about 5 feet is taken up by the head. The skeleton exhibited is from New Zealand, and was presented by the Wellington Museum in 1876. The species is also represented by a coloured cast of the head affixed to the north wall of the gallery; this was modelled from an Australian specimen and presented to the Museum by Dr. E. C. Stirling in 1892.

Grey Whale. This species (*Rhachianectes glaucus*), which appears to be restricted to the Pacific coasts of North America, where it ranges in summer to the Arctic Ocean, and in winter wanders as far south as latitude 20° N., differs from the Rorquals in the absence of a back-fin, and in the reduction of the pleats in the throat to two, as well as by the long scapula, or shoulder-blade. Of the fourteen pairs of ribs, the first two on each side are welded together; and the cross-shaped sternum, or breast-bone, differs from that of a Rorqual by the shortness of its arms and the sharp point formed by the hind end.

This Whale generally grows to a length of from 40 to 44 feet; and its colour varies from mottled grey to black, the whalebone being light-coloured and from 14 to 16 inches in length. It is essentially a coast-species, frequenting shoal-waters, and has been

observed to lie and gambol in the surf in a depth of 13 feet of water or even less; while at times it will allow itself to be well-nigh stranded, so that it cannot get away till the next tide. The species is at present represented in the gallery only by a miniature model.

Fig. 6.

Two views of the Right Tympanic Bone of the Common Rorqual (*Balænoptera musculus*), to show the rounded and shell-like form characteristic of all the species of *Balænoptera*. Half natural size.

Rorquals or Finwhales. Rorquals (genus *Balænoptera*) are distinguished from Right-Whales by the comparatively small and flat head, the narrow flippers, the long and slender body, the presence of a fin on the back, and of deep parallel furrows in the skin of the throat and chest. These furrows allow of the expansion of the region in which they are placed, so as to form a capacious pouch, capable of taking in a large quantity of water containing shoals of small fishes or other marine animals. On contracting the pouch, the water is driven out through the

meshes of the sieve formed by the whalebone, and the food remains to be swallowed. Owing to the small quantity and inferior quality of their whalebone, the comparatively limited amount of oil-producing fat, and the difficulty of capturing them by the old methods, owing to their great speed, these Whales until the last thirty years were not objects of pursuit by whalers; but since the introduction of steam-vessels and of explosive harpoons fired from guns, Rorqual-fisheries have been established on the coast of Finmark, in Shetland, and in Ireland, all under the management of Norwegians, where many hundreds are killed every summer, their bodies being towed to the shore for the purpose of flensing.

Four species inhabit the British seas, viz.: The Blue Rorqual (*Balænoptera sibbaldi*, or *B. musculus*, fig. 4), the largest of all known animals, attaining a length of 80, or perhaps sometimes 85, feet; the Common Rorqual (*B. musculus*, or *B. physalus*, fig. 7), from 60 to 70 feet long when full grown; the Northern, or Rudolphi's, Rorqual (*B. borealis*), not exceeding 50 feet in length; and the Lesser Rorqual (*B. rostrata*, or *B. acuto-rostrata*), never exceeding 30 feet in length.

Rorquals are met with in almost all seas, and nearly all the individuals examined so closely resemble one or other of the above-mentioned species that some naturalists incline to the belief that there are but four kinds, each having a wide, or almost cosmopolitan, range. The Lesser Rorqual, at any rate, has, however, several distinct local races.

In the genus *Balænoptera* the neck is longer than in *Balæna*, and the seven vertebræ are all free.

No specimen of the Blue Rorqual is at present exhibited in the Gallery.

Of the various species of Whalebone Whales the Common Rorqual (fig. 7) is the one most frequently met with in the seas round the British Isles, and often enters the Mediterranean. Adult specimens vary between sixty and seventy feet in length, and the species is only surpassed in size by the Blue Rorqual; its food consists of crustaceans and fishes up to the size of herrings. This Whale produces but a comparatively small quantity of oil, and its whalebone, being short and having little elasticity, is of scarcely any commercial value. Together with other Rorquals, it is, however, now caught off the coast of Finmark, as well as off the Shetlands, and the small island Inishskea, off the west coast of County Mayo, Ireland, where there are special whaling-

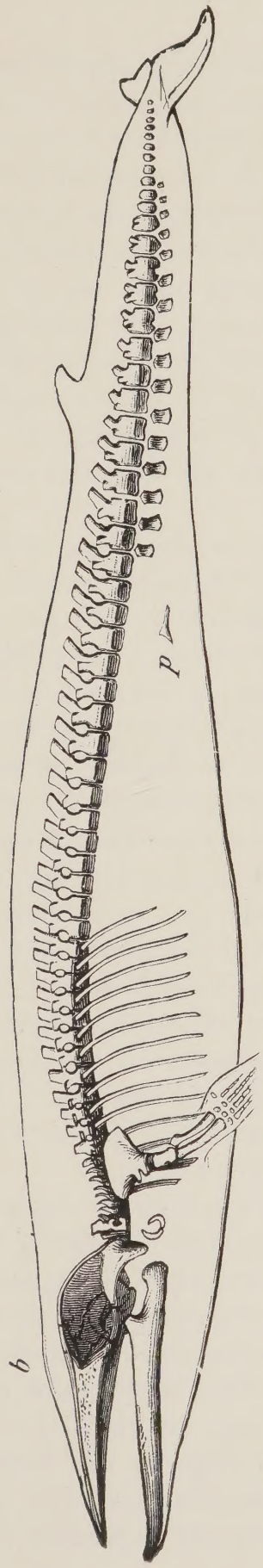


Fig. 7.

The Common Rorqual or Fin-Whale (*Balænoptera musculus*).
Skeleton and outline: *b*, position of blow-holes; *p*, pelvic bone.
About $\frac{1}{120}$ natural size.

stations. The skeleton exhibited is that of an adult male (sixty-nine feet long) taken in the Moray Firth, Scotland, on the 22nd of March, 1880: upon this has been built a half-model of the animal itself. The flukes, or tail, and the back-fin of the same specimen hang upon the wall at the end of the room; the whalebone is preserved in its natural position in the mouth.

Attention may be directed to a set of the seven cervical vertebræ of this Rorqual, which were taken from an adult male, sixty feet long, stranded near Stornoway, Lewis, in November, 1871; they were presented to the Museum by Sir John Struthers in 1889, and serve to show the complete separation of each element in the series, whereby the Rorquals are distinguished from the Right-Whales.

The Northern Rorqual, or Rudolphi's Whale (*Balænoptera borealis*), which, as already mentioned, never exceeds fifty feet in length, was formerly considered to be one of the rarest of all Whales, and was only known from a few individuals stranded on the coasts of Northern Europe at long intervals. The skeleton of the type specimen, which was taken in the Baltic in 1819, and is now in the Berlin Museum, was described by the Italian naturalist, Rudolphi, under the name of *B. rostrata;* but upon it was subsequently founded Cuvier's *Rorqual du Nord*, latinized by Lesson into *B. borealis*. Since the establishment of the whaling stations near the North Cape, this Whale has been shown to be a regular summer visitant to the coast of Finmark, and in 1885 as many as 771 individuals were captured there. It feeds chiefly upon minute crustaceans, and not on fish. The specimen shown is the skeleton of a nearly full grown male, taken in the Thames, near Tilbury, 19th October, 1887; and upon it has been built a half-model of the animal itself. The whalebone is longer than in the common species, and of some commercial value.

The smallest European member of the group is the Lesser Rorqual, or Pike-Whale (*Balænoptera rostrata*), which never exceeds thirty feet in length. The whalebone is yellowish white, and the outer surface of the flippers marked by a transverse white band. As in Rudolphi's Whale, the back-fin is relatively tall, and placed far forwards on the body. This Whale is of common occurrence in the fjords of Norway, frequently visits the British shores, and has been taken, although rarely, in the Mediterranean, and its range extends as far north as Davis Strait. At one time it was represented in the gallery by an immature female, captured off

Weymouth in 1871; but this specimen had to be destroyed, with the exception of the flukes, the back-fin, and one of the flippers, which are shown on the east wall of the building. The Museum possesses the skeleton of an immature Rorqual from Borneo which cannot be distinguished from this species; and specimens from Argentina indicate its occurrence in South American waters.

Humpbacked Whale. *Megaptera boöps*, or *M. nodosa*, the single well-defined representative of its genus, is a large Whale (fig. 5) nearly allied to the Rorquals, from which it is at once distinguished by the inordinate length of the flippers, which have their margins indented, or scalloped, and are generally of a pure glistening white, thus forming a marked contrast to the black of the upper-parts of the head and body. In length the flippers are nearly equal to one-fourth that of the entire head and body. The chin and throat are grooved, forming a dilatable pouch, as in the Rorquals; the back-fin is low, and the whole shape relatively short and thick. The usual length attained by this species ranges between 45 and 50 feet; the female being superior in size to the male. A peculiarity of the blade-bone, or scapula (of which a detached pair is exhibited on the north wall), is the absence or aborted condition of the acromion and coracoid processes. The whalebone is comparatively short, and deep black in colour.

Humpbacks are widely distributed over the Atlantic and Pacific Oceans, and are also met with in the Indian Ocean, although they rarely visit the British seas. They are remarkable for their sportive habits, frequently throwing themselves out of the water, and sometimes lying on one side just below the surface, with one long white flipper standing vertically out of the water.

In addition to the two specimens of the scapula, the species is represented by a miniature model of the entire animal (fig. 5), presented by the American Museum of Natural History in 1908, and exhibited in a case at the north-west corner of the room. Near by, in a jar of spirit, is displayed a portion of one of the flippers, the skin of which has attached to it a large cluster of Whale-Barnacles (*Coronula diadema*). This interesting specimen came from Japan, and was presented by Mr. G. F. Ringer. On the head of the model may be seen a number of rough excrescences, which appear to be characteristic of the species.

Toothed Whales. The members of this group, which form the suborder *Odontoceti*, differ in many points from Whalebone-Whales. They never have whalebone, but always possess teeth throughout life, although these may be few in number and confined to the lower jaw, and even rudimentary in character. The blow-hole, or external respiratory aperture, is single (the two nostrils uniting before they reach the surface), and is usually in the form of a transverse, crescent-shaped, valvular aperture, situated on the top of the head. Great want of symmetry characterises the skull; and the two halves of the lower jaw have a longer or shorter bony union. Toothed Whales are not only more numerous in species than Whalebone-Whales, but present much greater diversity of form; all the smaller members of the order belong to this group, and only one species (the Sperm-Whale) rivals in size the larger Whalebone-Whales.

Existing Toothed Whales are divisible into numerous generic groups, which may be arranged in the following five families:—

I. Physeteridæ, with *Physeter* and *Kogia*.
II. Ziphiidæ, with *Hyperoödon*, *Ziphius*, *Mesoplodon*, and *Berardius*.
III. Platanistidæ, with *Platanista*.
IV. Iniidæ, with *Inia* and *Pontoporia*.
V. Delphinidæ, with *Monodon*, *Delphinapterus*, *Phocæna*, *Cephalorhynchus*, *Orcella*, *Orca*, *Pseudorca*, *Globicephalus*, *Grampus*, *Feresia*, *Lagenorhynchus*, *Delphinus*, *Tursiops*, *Prodelphinus*, *Steno*, and *Sotalia*.

The leading characteristics of these families and of the more important generic groups into which they are divided will be found in the sequel.

Sperm-Whale or Cachalot. The true Sperm-Whale (*Physeter macrocephalus*, fig. 8) is the largest of the Toothed Whales, and the typical representative of the family *Physeteridæ*, which includes the Lesser Cachalot and a number of extinct Cetaceans. In both the living species functional teeth are restricted to the lower jaw, but there are numerous extinct *Physeteridæ* in which both jaws are furnished with a full series of teeth. In the existing species nearly all the ribs are two-headed; the rib-cartilages do not ossify; the petroso-tympanic bones are firmly united to the skull, which has large crests behind the

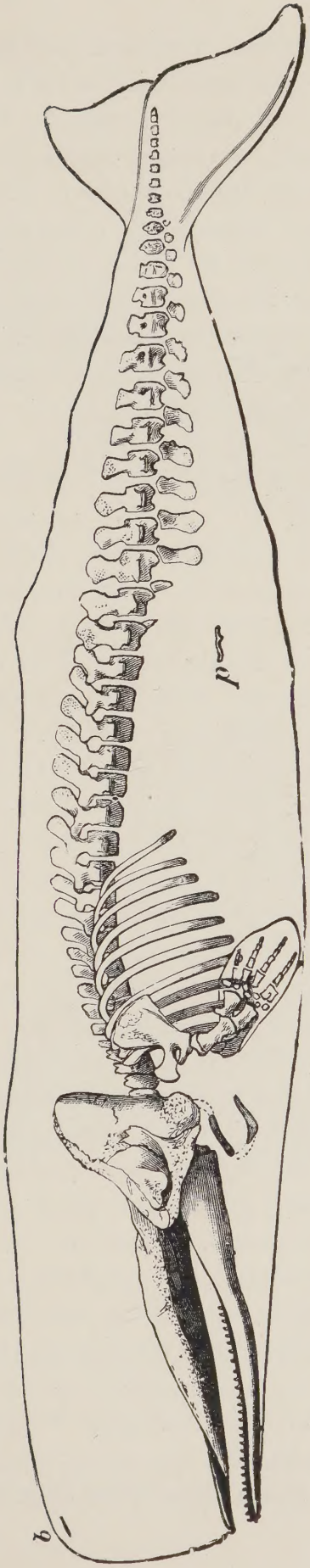


FIG. 8.

The Sperm-Whale or Cachalot (*Physeter macrocephalus*).
Skeleton and outline. *b*, nostril or blow-hole; *p*, rudimentary pelvic bone.
About $\frac{1}{100}$ natural size.

nostrils; some of the cervical vertebræ are fused together; the two halves of the lower jaw may have a long or a short union; the blow-hole is situated on the left side, and is longitudinal or oblique, with its concavity turned backwards; the stomach is muscular (which it is not in the *Ziphiidæ*); and the teeth in the lower jaw are numerous. There is no enamel on the teeth of the Cachalot, but this is present in those of the extinct genera in which functional teeth are developed in the upper jaw, the number in the premaxillæ being limited to three pairs. It may be added that in the existing Sperm-Whale teeth of considerable size—an inch or so in length—are embedded in the gums of the upper jaw, but never attain full development.

The Cachalot is one of the mostly distributed of all Whales, occurring usually in herds or "schools" in most warm seas; but ranging in summer so far north as the Shetlands and Iceland. The species occurs from time to time in the Mediterranean, as is indicated by the incised slab of whalebone referred to under the heading of the Greenland Whale (p. 14), and also by a skeleton in the Cambridge University Museum, prepared from a specimen taken off Lipari in the year 1902, a second and larger individual being seen at the same time. Old males are much larger than females, and have the front of the head abruptly truncated. The chief food of the Cachalot consists of cephalopods (squid and cuttlefish), some of enormous size.

The position of the external nostril near the anterior end of the head is exceptional. In the model the tube represents the course of the left nasal passage, which is alone pervious, and shows the direction of the jet of vapour, by which the "blowing" or breathing of the Sperm-Whale may be distinguished from that of other Whales (in which it ascends vertically) at a distance. The want of symmetry of the nasal region of the skull, and the reduction in the size of the right nasal aperture are noteworthy. A great part of the space above the skull is occupied by the receptacles for the spermaceti, which is a liquid oil at the temperature of the living animal, but solidifies on cooling, and when refined constitutes the white, crystalline spermaceti of commerce, used for candles and ointments; its use in the economy of the animal is unknown.

A near relative of the Sperm-Whale is the Lesser Cachalot (*Kogia*), mentioned on page 26.

The extinct genera include *Balænodon* (*Scaldicetus*, *Hoplocetus*,

FIG. 9.

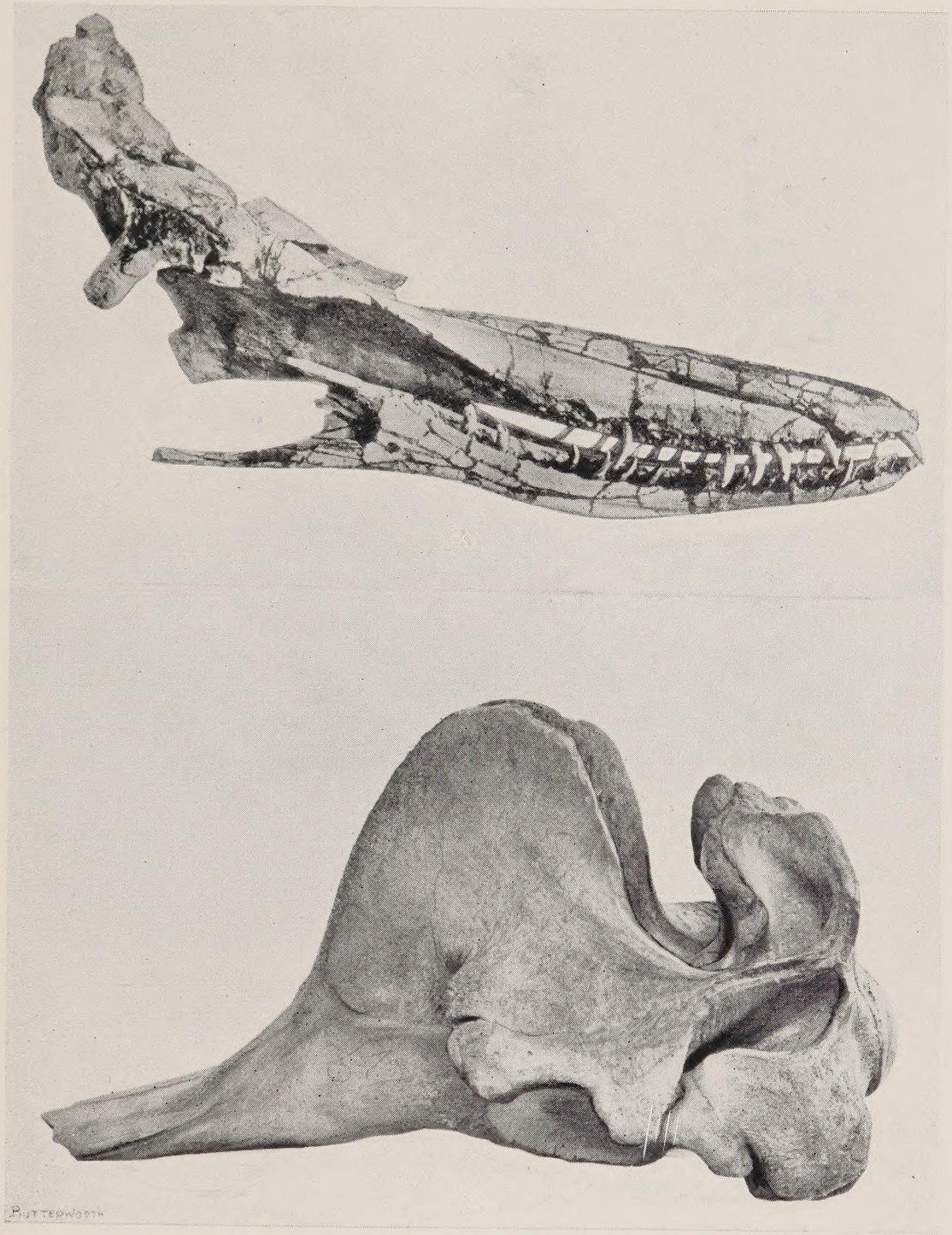


FIG. 10.

FIG. 9. Imperfect Skull of an Extinct Sperm-Whale (*Balænodon patagonicus*), from the Middle Tertiary deposits of Patagonia. About $\frac{1}{16}$ natural size.

FIG. 10. Skull, without lower jaw, of an old male Bottle-nosed Whale (*Hyperoödon rostratus*). About $\frac{1}{18}$ natural size.

[*To face page* 24.

Physodon, *Eucetus*, or *Dinoziphius*), *Thalassocetus*, *Physeterula*, *Prophyseter*, *Placoziphius*, and *Hypocetus* (*Diaphorocetus*), all of which have teeth in both jaws. The last of these, which is common to the Miocene of North and South America, seems to be the ancestor of *Physeter* or *Kogia*, probably of the former.

The Sperm-Whale itself is represented in the gallery by the skeleton (upon which a half-model is built) of an old male, washed ashore in Sandside Bay, near Thurso, Caithness, in July, 1863. The specimen measured fifty-five feet in length, and was presented by Captain D. Macdonald, R.E.

On the eastern wall of the room are suspended four lower jaws of young Sperm-Whales. Two of these have been injured in life, probably through collisions, and their extremities have consequently grown in a curve.

In one of the table-cases at the north end of the room is exhibited a considerable series of detached teeth of the Sperm-Whale. As already mentioned, and as shown in the complete skeleton, functional teeth are developed only in the lower jaw of the Sperm-Whale; these vary in number from 20 to 25 pairs, the largest being situated in the middle of the series. They have no enamel, and consist externally of the substance known as cement, and internally of dentine, together with nodules of a harder variety of the same substance termed vaso-dentine. The pulp-cavity remains open throughout life in these teeth. On one of the smaller specimens has been incised a sketch of a Sperm-Whale hunt, in which the truncated front of the head characteristic of old bulls is distinctly shown.

In another case are exhibited a number of fossilised teeth of extinct Sperm-Whales. The "Crag," or Pliocene formation, of East Anglia and late Tertiary deposits in other parts of the world yield teeth of various extinct Cetaceans more or less nearly allied to the Sperm-Whale. They have been referred to a number of genera, such as *Balænodon*, *Scaldicetus*, *Eucetus*, and *Physodon*, but these appear to be for the most part inseparable. These extinct Sperm-Whales are distinguished by the presence of teeth in the upper as well as in the lower jaw (fig. 9). The teeth differ from those of the Sperm-Whale in having a cap of enamel on the summit; while some of them are characterised by their nearly circular cross-section, and by the swollen size of the aperture of the central pulp-cavity.

Ambergris (literally "grey amber") is a concretion formed in

the intestine of the Sperm-Whale, and found floating on the surface of the sea in masses of considerable size. It generally contains the horny beaks of squids and cuttles on which the Whale feeds, or fragments of the same. Ambergris is largely employed in perfumery, and commands a high price, commonly as much as 90*s.* per oz. The specimen exhibited in the upright case at the north-western corner of the room was purchased in 1905, and weighs $4\frac{1}{4}$ ounces.

Lesser Cachalot. Closely allied in structure to the true Cachalot, or Sperm-Whale, the Lesser Cachalot (*Kogia breviceps*) differs markedly in size (not exceeding ten feet in length), and also in lacking the disproportionately large size of the head. The union between the two halves of the lower jaw is shorter than in the true Cachalot, and there are also fewer teeth. It is very widely distributed, having been met with in various parts of the Indian and Southern Oceans, and in the North Pacific; but has not occurred in British waters. Whether the differences that have been noted in different specimens are to be attributed to variations depending upon sex, age, or locality, or whether there are several distinct species of the genus, is still undetermined. Spermaceti is yielded by this Whale. The species is represented by the skeleton of an adult, from Trincomalee, Ceylon, presented by Mr. Hugh Neville in 1891.

Beaked Whales. The Beaked Whales (*Ziphius*, *Mesoplodon*, and *Berardius*), together with the Bottle-nosed Whale (*Hyperoödon*), typify a family (*Ziphiidæ*) nearly related to the *Physeteridæ*, but with certain distinctive features of its own. In many of the extinct genera both jaws carried teeth; but in the living species the functional dentition is reduced to one or two pairs of large teeth in the lower jaw; these being larger in males than in females, and in *Mesoplodon* having a thin layer of enamel. There are, however, minute teeth (to the number of 17 or 19 pairs) in both jaws of *Mesoplodon* which never cut the jaw. In the extinct *Palæoziphius* there is little difference in the size of the individual teeth. The mandibular symphysis is long in the more ancient, but short in the recent genera. The skull is compressed into a high crest, with thick and massive pterygoid bones, and the beak often formed by a massive rod of ivory-like bone. The first two cervical vertebræ are fused, but the condition of the others

varies; all the latter being generally free in *Mesoplodon*, whereas in *Hyperoödon* the whole of them, and also the first dorsal, are united. The flippers are situated higher up than in the Sperm-Whales.

Of the existing genera, *Ziphius*, as represented by Cuvier's Beaked Whale (*Z. cavirostris*), has a pair of moderate-sized conical teeth in the front of the lower jaw; and in the skull the premaxillary bones around the nostrils are expanded into forwardly-curving crests, of which the right is the larger. Small tuberosities are developed on the maxillæ at the sides of the root of the beak. In *Mesoplodon* the single pair of lower teeth is generally placed some distance behind the apex of the lower jaw; and there are no tuberosities on the maxillæ; in one kind, *M. layardi*, the teeth (fig. 12) assume a strap-like form, curving over the beak, so that it

Fig. 11.

The Left Periotic (Petrosal) Bone of a Beaked Whale (*Mesoplodon bidens*), to show the type characteristic of the family. Natural size.

is difficult to understand how the mouth can be opened. *Berardius arnuxi* is characterised by the possession of two pairs of moderate-sized lower teeth; it inhabits the New Zealand seas.

Mesoplodon is found fossil, in association with the allied *Choneziphius*, in the Red Crag. *Mioziphius*, *Cetorhynchus*, and *Palæoziphius* are extinct genera, of which the third has the dentition complete.

Among the specimens exhibited are two half-casts of Sowerby's Beaked Whale (*Mesoplodon bidens*), made from specimens taken off Bergen, Norway. There is also a cast of the head of the same species, made from a male stranded on the Island of Karmoe, Norway, on the 29th August, 1895, and described and figured in the "Bergens Museums Aarbog" for 1897. All these three specimens were presented by the Bergen Museum. A skull from Aberdeenshire, presented in 1908, is shown in the table-case. In the same

case is exhibited a skull from South Africa of Layard's Beaked Whale (*M. layardi*), the species referred to above as remarkable for the extraordinary development of the single pair of lower teeth. A skull of the New Zealand Beaked Whale known as *M. hectori* is likewise placed in this case.

Near by is shown a skeleton of the Chatham Island Beaked Whale (*Ziphius chathamensis*), from New Zealand, collected by Sir Julius von Haast. The specific distinction between this Beaked Whale and the typical *Z. cavirostris* is not well established. Of the latter, two skulls are shown in the table-case, both from South Africa; one of these, like the skull of Layard's Beaked Whale (fig. 12), was presented by the Trustees of the South African Museum; the other was acquired by purchase.

Berardius arnuxi is represented only by a single tooth, from New Zealand; it is of the large size distinctive of the genus.

In a table-case at the south end of the gallery, next the one with the recent skulls of the same group, are displayed a number of remains of extinct Beaked Whales. These most commonly take the form of the solid beaks, or rostra, of the skull, which are preserved in the "Crag" of East Anglia, as well as in other late Tertiary Deposits. Some of these beaks are referred to the existing genus *Mesoplodon*, but others indicate distinct generic types. Among the latter, *Choneziphius* differs from *Mesoplodon* in the relations of the premaxillæ to the vomer, in the small portion of the latter exposed on the under surface of the beak, and also in the presence of a hollow tube in the latter, due to the non-ossification of the mesethmoid cartilage.

Bottle-nosed Whale. The Bottle-nosed Whale (*Hyperoödon rostratus*) also belongs to the family *Ziphiidæ*, of which the characteristics are given in the paragraph devoted to the Beaked Whales. The muzzle is elongated into a beak, from above which rises somewhat abruptly an eminence formed by a cushion of fat resting on the skull in front of the single crescentic blow-hole. From its allies the Bottle-nose is distinguished by having a single pair of teeth, concealed during life in the gum, at the extremity of the lower jaw, and also by the great development—especially in the adult—of the pre-maxillary crests of the skull. This species is one of the commonest of British Cetaceans, and feeds chiefly upon cuttle-fishes and squids. Males grow to 30, and females to 24 feet. It yields a kind of spermaceti

FIG. 12.

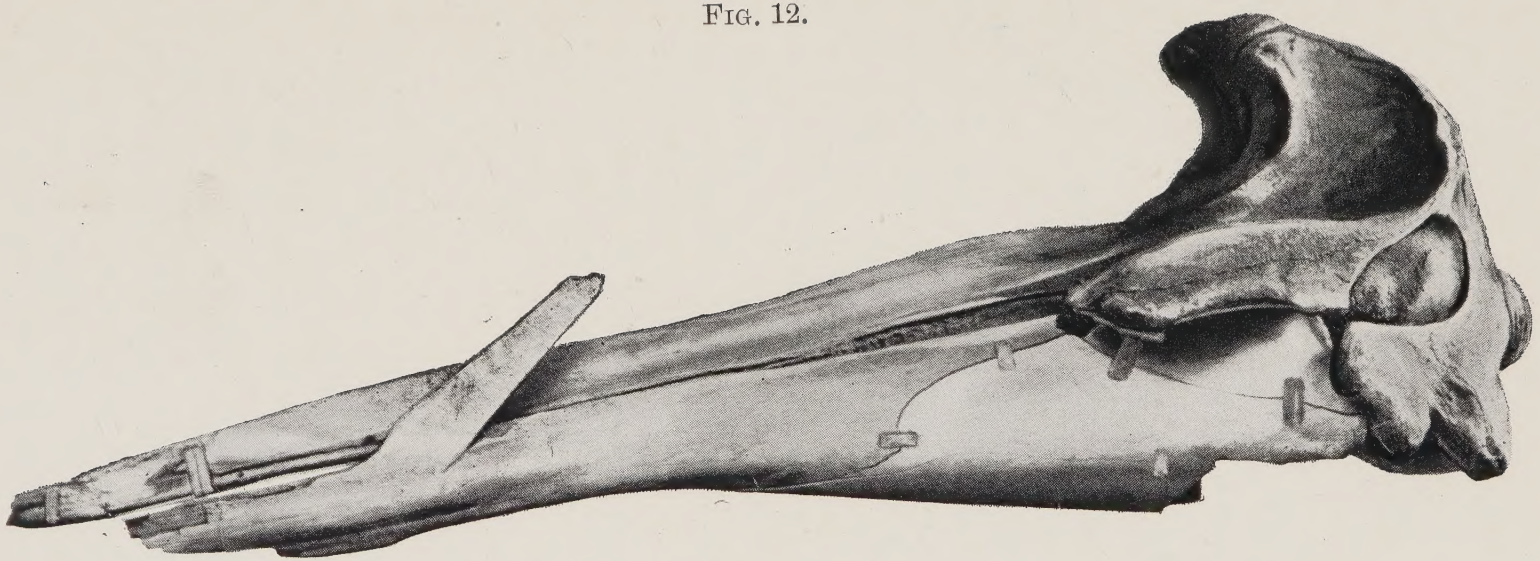


FIG. 13.

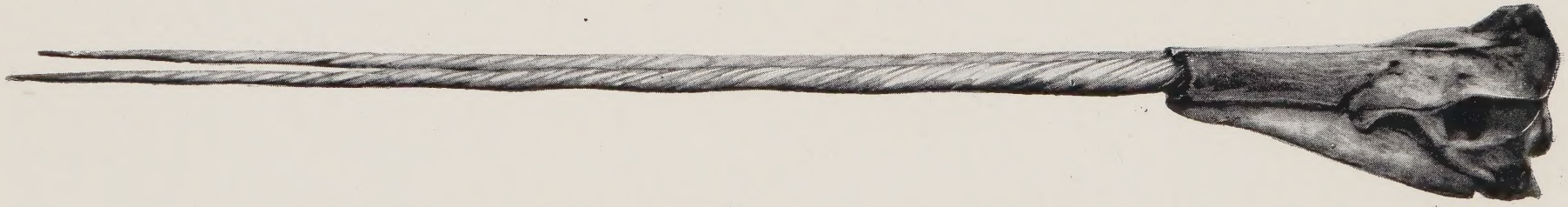


FIG. 12. Skull of Layard's Beaked Whale (*Mesoplodon layardi*).
FIG. 13. Skull of Double-tusked Narwhal (*Monodon monoceros*).
Fig. 12 about $\frac{1}{8}$, fig. 13 $\frac{1}{14}$ natural size.

[*To face page* 28.

differing somewhat in quality from that of the Cachalot; and a few years ago these Whales were extensively hunted for the sake of this product. The skeleton exhibited is that of a female or young male; while the skull beside it (fig. 10) is that of a very old male taken in the Orkneys. The huge size and close approximation of the premaxillary crests of the skull characteristic of aged individuals of that sex are well shown in the latter specimen; in the females they remain throughout life comparatively small and widely separated. The external form of the Bottle-nose is exhibited by means of a miniature model of an adult male.

Dolphin-like Beaked Whales. Certain Cetaceans from the Miocene Tertiary deposits of Europe and North America, described under the name of *Eurhinodelphis*, represent an extinct family—the *Eurhinodelphidæ*—which is evidently related to the *Ziphiidæ*, but possesses certain distinctive peculiarities. Among these characteristic features, are the small size of the pterygoid bones, the long, toothless premaxillæ, and the Dolphin-like prenarial region of the skull. The premaxillæ form the greater portion of the very long beak; the maxillæ carry from 37 to 60 conical teeth; and the skull is of the general type of that of the *Ziphiidæ*, in some cases slightly convex, in others with a bold transverse crest.

The group, of which no examples are exhibited in the building, forms a primitive type evidently related to the *Ziphiidæ*, but none of the species at present known can be regarded as ancestral to the latter.

River-Dolphins. Three living species of Dolphins, respectively inhabiting the rivers and estuaries of India, the Upper Amazon, and the Rio de la Plata, represent two distinct families. These are shown in the case on the left side of the vestibule of the Whale Room. The first of these is the *Platanistidæ*, including only the Susu (*Platanista gangetica*) of the Ganges, Indus, and Bramaputra, which ascends those rivers almost to their sources, but never passes out to sea. In common with the next family, the Susu (fig. 14) has eight double-headed ribs and a long beak; its costal cartilages ossify late in life; the petrosal and tympanic bones are connected with the skull mainly by ligament; the temporal fossa is large; all the cervical vertebræ are free; teeth are present in both jaws; and the flippers are

short and wide. From the next family the *Platanistidæ* differ by the slit-like form of the blow-hole, the presence of a cæcum to the intestine, the development of a high crest on each maxilla (fig. 15), and by the teeth undergoing remarkable changes with age. The Susu, which grows to a length of 8 feet, is blind, and feeds by groping in the mud of the rivers for crustaceans and small fishes. It is represented by a stuffed specimen, a skeleton, and several skulls, some showing the thin, sharp young teeth, and others the thick, blunt ones of maturity.

The second family, *Iniidæ*, includes the Amazonian Dolphin (*Inia geoffroyensis*), which grows to 7 feet, and the La Plata Dolphin (*Pontoporia*, or *Stenodelphis*, *blainvillei*), inhabiting the estuary of the Rio de la Plata, and scarcely exceeding 4 feet in length, together with a number of extinct genera. In both recent species the opening of the blow-hole is crescentic, there is no cæcum to the intestine, the upper jaw does not carry crests, and the transverse processes of the lumbar vertebræ are very broad. The snout of *Inia* retains a number of scattered bristly hairs. In the La Plata Dolphin the beak is very long, with from 50 to 60 pairs of teeth; and there is a back-fin which is wanting in both the Amazonian Dolphin and the Susu. The La Plata Dolphin (fig. 16) is represented by a coloured sketch and a plaster cast of a specimen taken in 1893 in the Bay of Monte Video, as well as by the skull and skeleton. Of the Amazonian species only the skull and skeleton are shown.

The La Plata Dolphin has the cervical vertebræ separate and the transverse processes of the lumbar vertebræ very broad, as in *Inia*, but the pterygoid bones of the skull are involuted, the sternal ribs (costal cartilages) are ossified, and the true ribs articulate with the vertebræ in the same manner as in the *Delphinidæ*. The extinct *Pontistes* is very close to *Pontoporia* (*Stenodelphis*), but larger. In both these genera the prenarial region of the skull, and also the shape of the nasal bones and the form of the zygomatic process, recall the corresponding regions in the Porpoise (*Phocæna*).

The two living species, together with the extinct Argentine genus *Pontistes*, constitute the subfamily *Iniidæ;* in addition there are two extinct subfamilies, the *Argyrocetinæ* (with the genera *Argyrocetus*, *Cyrtodelphis*, *Pontivaga*, *Ischyrorhynchus*, and *Champsodelphis*) and the *Acrodelphinæ* (with *Acrodelphis* and *Heterodelphis*). The *Argyrocetinæ*, of which the type genus is from the Miocene of S. America, although several of the others are Euro-

Fig. 14.

Fig. 15.

Fig. 16.

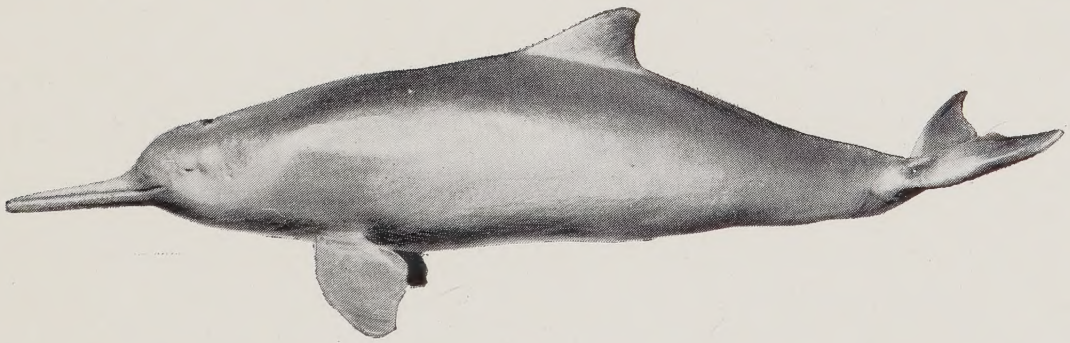


Fig. 14. The Susu (*Platanista gangetica.*). About $\frac{1}{16}$ natural size.
Fig. 15. Skull of the Susu. About $\frac{1}{5}$ natural size.
Fig. 16. The La Plata Dolphin (*Pontoporia blainvillei*). About $\frac{1}{13}$ natural size.

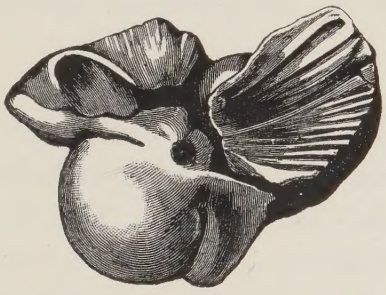
[*To face page* 30.

pean, have flat skulls, very long beaks with a great number of teeth, and the frontal bones forming a broad zone on the forehead. In the *Acrodelphinæ* the frontal zone is narrower, and the teeth in the type genus have numerous accessory denticules apparently representing the serrations on those of the extinct *Squalodon*, a genus mentioned later. The Patagonian *Argyrodelphis*, of which the skull is shown in fig. 29, also belongs to this group.

Dolphins and Porpoises.

In the family *Delphinidæ* are included all the existing toothed Cetaceans which do not come under the definition of the *Physeteridæ*, *Ziphiidæ*, *Platanistidæ*, or *Iniidæ*. From the existing representatives of the first two the members of this family are distinguished by the general presence of teeth in both jaws, as well as by the characters of the skull, while from the two last they differ by the mode of articula-

Fig. 17.



The Left Periotic (Petrosal) Bone of a Pilot-Whale (*Globicephalus melas*), to show the type characteristic of the *Delphinidæ*. The difference between this bone and the corresponding element in the Beaked Whales will be apparent by comparing this figure with the one on page 27. Natural size.

tion of the ribs with the vertebræ. There are only four or five ribs with double heads ; the costal cartilages are fully ossified at an early age; the petroso-tympanics (fig. 17), which differ in form from the corresponding bones of the *Physeteridæ* and *Ziphiidæ*, are united by ligament with the skull; and the blow-hole is situated on the right side, and has the horns of the crescent pointing forwards. The nasal bones are short ; the skull has no crests ; and the teeth are smooth.

The family is divisible into the subfamilies *Delphinapterinæ* and *Delphininæ*, in the first of which all the cervical vertebræ are free. In this are included only the Narwhal (*Monodon*) and the Beluga, or White Whale (*Delphinapterus*). In the second subfamily at least the first two cervical vertebræ are united. It

includes two groups, in the first of which there is no distinct beak. This group comprises the Porpoise (*Phocæna*), the species of *Cephalorhynchus*, the estuarine Dolphins of the genus *Orcella*, the Killer (*Orca*), False Killer (*Pseudorca*), Pilot-Whale (*Globicephalus*), and the Dolphins of the genera *Grampus*, *Feresia*, and *Lagenorhynchus*.

In the second group of the *Delphininæ* the fore part of the head is prolonged into a distinct beak, marked off from the fatty elevation in front of the blow-hole by a V-shaped groove. None of the species exceed ten feet in length. The majority feed on fish, for the capture of which their long narrow beaks, armed with numerous sharp teeth, are well adapted; but a few appear to devour molluscs and crustaceans. For the most part they associate in large shoals; and although the majority are marine, a few habitually dwell in large rivers like the Amazon. This group includes the true Dolphins (*Delphinus*), Bottle-nosed Dolphins (*Tursiops*), and numerous long-beaked species of the genera *Prodelphinus*, *Steno*, and *Sotalia*.

White Whale. The Beluga or White Whale (*Delphinapterus leucas*) is a well-known species, occurring in large herds, or "schools," throughout the Arctic Seas. Together with the Narwhal, it constitutes the subfamily *Delphinapterinæ*, which differs from other *Delphinidæ* in having all the vertebræ of the neck free. On the east coast of America the White Whale is found so far south as the Gulf of St. Lawrence, sometimes ascending that river as high as Quebec. It is abundant in the White, Kara, and Okhotsk Seas, and enters the mouths of all the large Siberian rivers, including the Amur, and also the Yukon in Alaska. Accidental stragglers have been met with off Norway, and more rarely on the coasts of the British Isles. This Whale, which is of a uniform glistening creamy white colour, feeds on fishes of considerable size, cephalopods, and crustaceans, and its skin is the principal source of the so-called "porpoise-hide" extensively used for shooting boots and boot-laces.

It is represented in the room by a skeleton upon which a half-model has been constructed. The skeleton itself came from Greenland. On some occasions enormous numbers of these Cetaceans are slain, especially in Alaska; specimens have occasionally been seen on the coasts of Scotland. This species, like the Narwhal, has no back-fin.

Fig. 18.

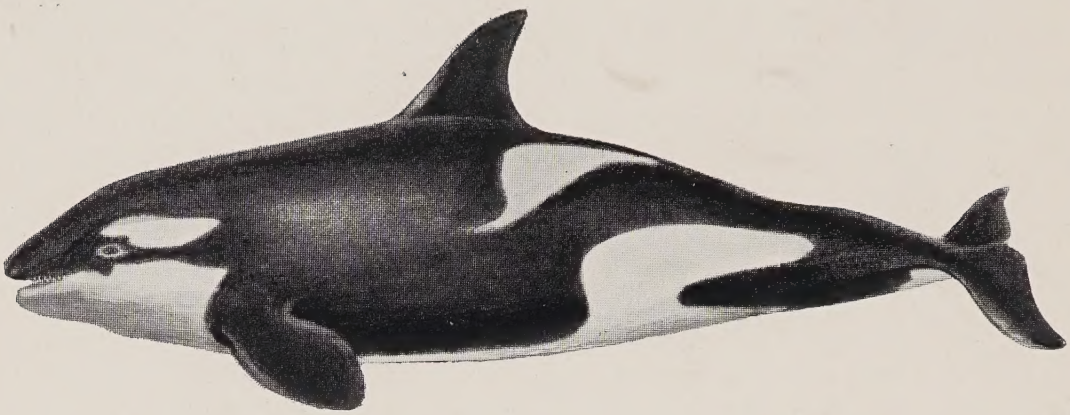


Fig. 19.

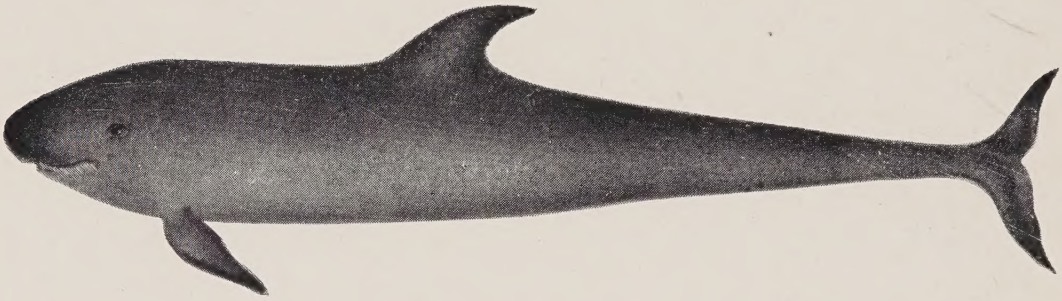


Fig. 20.

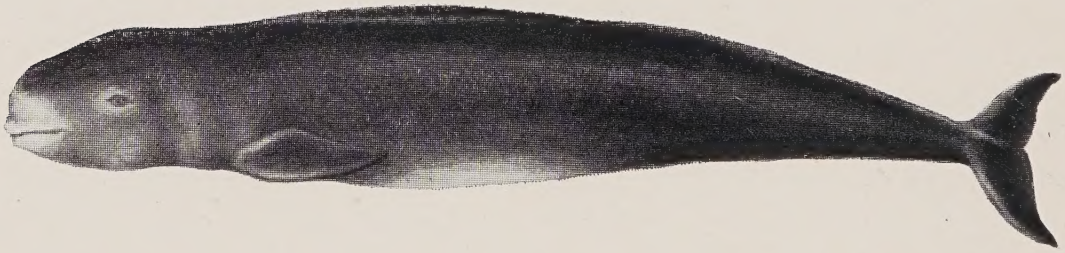


Fig. 21.

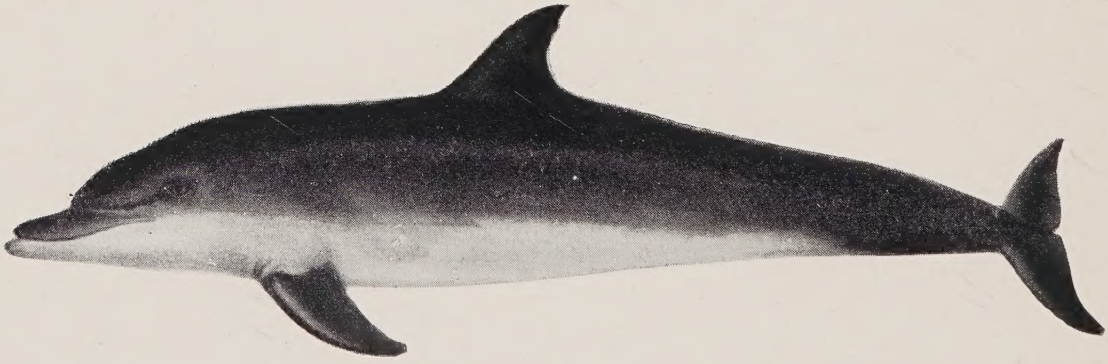


Fig. 18. The Killer (*Orca gladiator*).
Fig. 19. The False Killer (*Pseudorca crassidens*).
Fig. 20. The Indian Porpoise (*Neomeris phocænoides*).
Fig. 21. Indian Bottle-nosed Dolphin (*Tursiops abusalam*).

Fig. 18 about $\frac{1}{50}$, Fig. 19 $\frac{1}{44}$, Fig. 20 $\frac{1}{20}$, Fig. 21 $\frac{1}{30}$ natural size.

[*To face page* 33.

Narwhal. From all other Cetaceans the Narwhal (*Monodon monoceros*) of the Arctic Seas is distinguished by the peculiar character of the dentition, which is in striking contrast to that of its cousin the White Whale. Apart from some rudimentary teeth, the entire adult dentition is reduced to a single pair of upper tusks. In the female these remain permanently concealed in the bone of the jaw; and usually the right tooth of the male exhibits the same condition, while the left one alone is developed into a long spirally-twisted tusk. Very rarely, as in one of the specimens exhibited, both tusks may be developed. In the general contour of the head and body the Narwhal is very like the Beluga, but the skin is marked and spotted with various shades of grey. Narwhal feed on cephalopods, crustaceans, and fishes. The specimens exhibited include the skeleton of a male, and the skull of a second specimen in which both tusks are developed; the latter was purchased in 1885. Upon the skeleton has been built a half-model of the animal; and an immature stuffed specimen is likewise shown. In the double-tusked skull (fig. 13) it will be noticed that the spiral in both tusks is twisted in the same direction; this forms a remarkable contrast to spiral-horned animals, in which one horn always forms a right-handed and the other a left-handed spiral. Some fine specimens of Narwhal-tusks are exhibited on the north wall of the building.

Killer. With the Grampus or Killer (*Orca gladiator* or *Orcinus orca*) we come to the first of the *Delphininæ*, or typical subfamily of the Dolphin group, in all of which at least two of the vertebræ of the neck are soldered together. Together with a few allied genera, the Killer (fig. 18) belongs to a subgroup characterised by the absence of a distinct beak to the muzzle. Killers are distinguished from their allies by their great ferocity, being the only Cetaceans which habitually prey on warm-blooded animals. Though fishes form part of their food, they also attack and devour Seals and various species of their own order, not only the smaller Porpoises and Dolphins, but even full-sized Whales, which they hunt in packs. Killers are met with in almost all seas, from Greenland to Tasmania, presenting much the same external appearance, but whether they all belong to one species is uncertain. They are readily known when swimming in the water by the high, narrow back-fin, this often attaining a still greater height than in the specimen shown in the gallery, which is a cast, carefully

coloured from nature, of an adult female taken in the mouth of the Humber in November, 1885. A skull is shown in the wall-case at the south end of the gallery, which exhibits the series of large and powerful teeth characteristic of the genus, and likewise displays the blunt and rounded form of the muzzle. In general colour the Killer is black, but there is a pair of oblique white bands on the hind part of the flanks in very nearly the same situation as in the under-mentioned Heaviside's Dolphin.

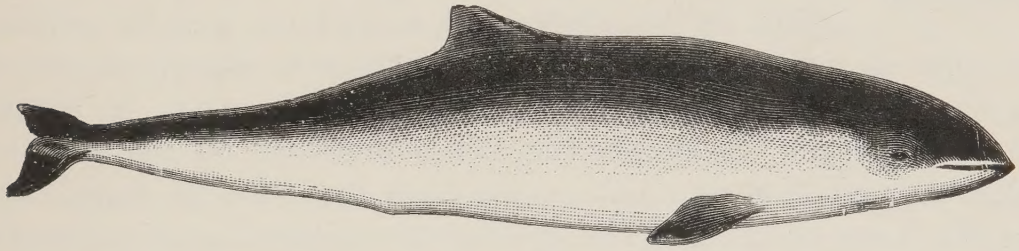
False Killer. The False Killer (*Pseudorca crassidens*), first made known to science on the evidence of a skull dug up in the fens of Lincolnshire, is nearly related to the Killer, from which it differs by the smaller number (about ten pairs) of teeth and the cylindrical form of their roots. The flippers, too, are smaller, and of a narrow and pointed form, while the back-fin is much lower (fig. 19). The shape of the head is also different, being high in front of the blow-hole, and compressed anteriorly, with the snout truncated. More of the neck-vertebræ are united together than in the Killer, and the lumbar vertebræ are also proportionately longer. In colour this Cetacean, which has been met with in seas so widely separated as those of Denmark and Tasmania, is entirely black; its length is about 14 feet.

The skeleton exhibited is from an individual out of a "school" which visited Adventure Bay, Tasmania, some time before 1866. Specimens have been taken on the coast of Travancore, India, from one of which the accompanying illustration (fig. 19) was taken.

Irawadi Dolphin. In the Irawadi Dolphin (*Orcella*, or *Orcaella*, *fluminalis*), and in the closely allied species (*O. brevirostris*) from the Bay of Bengal, there are from 12 to 14 pairs of small, conical, pointed, and rather closely set teeth, occupying nearly the whole length of the jaws, which are about as long as the rest of the skull. There is a small back-fin, placed somewhat behind the middle of the body; and the flippers are of medium length, with all the bones of the digits, except the first joints of the second and third, broader than long. The species first-named is found in the Irawadi River, Burma, at distances of from 300 to 900 miles from the sea.

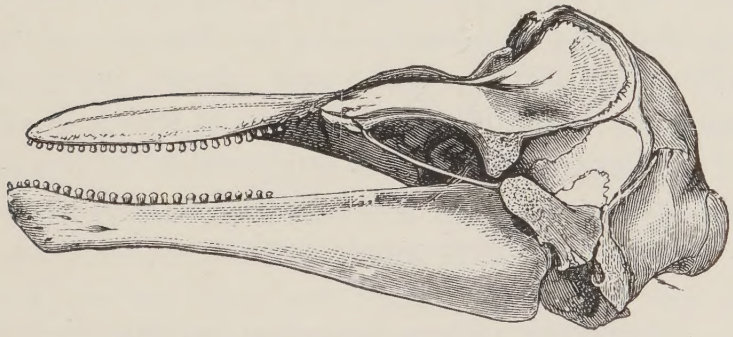
Porpoise. The Porpoise (*Phocæna communis*, or *P. phocæna*) is the smallest and most common of the Cetaceans found in the seas around the British Isles; and it also frequents the Scandinavian coasts, entering the Baltic in summer, and ranging as far north as Baffin's Bay, and west to the shores of the United States. Southward it is met with as far as the Azores, and occasionally, though rarely, enters the Mediterranean. The Black Sea Porpoise has, however, been described as a distinct species, *P. relicta*. On the other hand, specimens similar to, if not

Fig. 22.



The Porpoise (*Phocæna communis*).
About $\frac{1}{18}$ natural size.

Fig. 23.



Skull of the Porpoise.
About $\frac{1}{5}$ natural size.

specifically identical with, the ordinary Porpoise have been described from the mouth of the Rio de la Plata and the American coast of the North Pacific. The Porpoise (fig. 22) is sociable and gregarious in its habits, being usually seen in small herds. It feeds on fishes, such as mackerel, pilchards, and herrings, of which it devours large quantities, and, following the shoals, is often caught by fishermen in their nets. It is represented in the building by the cast of a complete specimen taken on the Atlantic coast of North America, and also by the model of a head. Both were presented by the United States National Museum. Together with

its immediate allies, the Porpoise differs from other members of the Dolphin family by the peculiar form of its teeth, which have spade-shaped instead of sharp and conical crowns (fig. 23). The external form is well shown in the American specimen and the accompanying illustration (fig. 22). The porpoise-hide of commerce is chiefly, if not entirely, White-whale-skin; the skin of the porpoise itself being too thin and too oily to be of much use.

Indian Porpoise Although nearly related to the common species, the Indian Porpoise (*Neomeris*, or *Neophocæna*, *phocænoides*) differs by the absence of a back-fin, and the smaller number of the teeth, which are also relatively larger. In size it is somewhat inferior to the Porpoise, and its colour is almost entirely black. The species (fig. 20) is abundant off the coast of Bombay and Madras, and has also been met with off Japan, and in the Yang-tsi-kiang. The specimens exhibited include a female taken in the Yang-tsi-kiang, off Ichang, Central China, at a distance of nearly one thousand miles from the sea, and purchased in 1888; the skeleton of the same individual being also shown. There is also the cast of a smaller individual taken on the coast of Travancore, Madras, and presented by the Director of the Museum at Trivandrum in 1904. This cast shows very distinctly a depressed area in the middle of the back, in which the skin carries a number of minute horny scales, supposed to be the remnants of a bony and horny armour protecting the extinct Zeuglodonts (referred to at the end of this guide-book).

Heaviside's Dolphin. Although nearly related to the Porpoise, Heaviside's Dolphin (*Cephalorhynchus heavisidei*), which represents a genus by itself, is specially distinguished by the greater relative length of the muzzle, this being at least as long as the hind portion of the skull. The teeth are of small size, and range from 25 to 30 in number on each side of both jaws. The back-fin (fig. 24) is low and bluntly triangular or rounded; while the flippers are rather small, narrow, and ovate. A distinctive feature of the species is the form of the white markings on the under surface, which, as already mentioned, recall those of the Killer. This Dolphin, which is smaller than the Porpoise, is an inhabitant of the seas of the southern hemisphere. The mounted specimen exhibited, which is the type of the species, was presented

by Captain Heaviside to the Royal College of Surgeons, from whose Museum it was obtained by exchange in 1841.

Pilot-Whale. The Pilot-Whale, Grindwal, or Blackfish (*Globicephalus*, or *Globicephala*, *melas*), as this species is called, is an inhabitant of nearly all seas, and easily distinguished by its nearly uniform black colour, rounded head, low and triangular back-fin, and the great length and narrowness of the flippers. There are from 8 to 12 pairs of small, conical, sharp teeth in the fore-part of each jaw. The Pilot-Whale of the North Atlantic grows to about 20 feet in length, and is a sociable and inoffensive animal, feeding chiefly on cuttles and squids. When a "school" is attacked, all the members crowd together, and can thus be easily driven ashore by boats, so that in the Faroes hundreds are frequently captured at a time in this manner. Specimens from New Zealand seem indistinguishable from British examples. This Cetacean is represented in the Whale Room by a skeleton, upon which a half-model of the external form has been constructed; and likewise by plaster-casts of the heads of an adult and an immature specimen exhibited on the west wall.

There is also exhibited a disarticulated skull of a young Pilot-Whale, in order to show the type of skull-structure characteristic of Cetaceans generally; this being modified in a very peculiar manner from the ordinary Mammalian type. The brain-case is short, broad, and high; in fact, almost spherical. The *Supra-occipital* bone rises upwards and forwards from the *Foramen Magnum*, to meet the *Frontal* bones at the vertex; thus excluding the *Parietal* bones from the upper surface of the skull. The *Frontals* are expanded laterally, so as to form the roof of the *Orbits*, or Eye-sockets; but their outer surface is so overlapped by the expanded *Maxillæ*, or hind upper jaw-bones, that only a small rim is exposed. The *Nasal* bones are always small, and in the Toothed Whales are reduced to mere nodules, which do not roof over any part of the nose-cavity. The latter opens upwards, and has in front of it a more or less horizontally-prolonged *Rostrum*, or Beak, formed of the *Maxillæ*, *Premaxillæ*, *Vomer*, and *Meseth-moid Cartilage*, which extends forwards to form the upper jaw, or roof of the mouth. Very frequently the skull is more or less asymmetrical in the neighbourhood of the nose-cavity, or blow-hole. This specimen was received from the Dundee Museum in 1892.

Risso's Dolphin. Risso's Dolphin (*Grampus griseus*), the sole representative of its genus, is a near ally of the Pilot-Whale, from which it differs by the total absence of teeth in the upper jaw, and the reduction of those in the lower jaw to from three to seven pairs, situated near the extremity. The fore part of the head is somewhat less rounded, and the flippers are shorter. This species grows to about thirteen feet in length, and is remarkable for its great variability in colour, although the general tint is a bluish grey. The skin of adult specimens frequently exhibits a number of scratches, each showing three parallel lines: these are produced by the triple hooks in the suckers of a squid on which this Cetacean feeds. Somewhat similar marks are noticeable on the hide of Sowerby's Beaked Whale, a species which also feeds on cuttlefish and squids. The species has been found, although rarely, in the North Atlantic and Mediterranean; and is represented by a closely allied, if not identical, form at the Cape. The stuffed specimen exhibited is a young female, taken in the English Channel in March, 1870, and purchased in 1871; plaster-casts of two heads are also shown on the west wall, both the gift of the U.S. Government.

Dolphin. The common Dolphin (*Delphinus delphis*) is one of several closely allied small Cetaceans presenting the following characters. The muzzle is elongated so as to form a distinct beak (fig. 27), separated by a V-shaped groove from the fatty cushion in front of the blow-hole; the teeth, which are very numerous, are small, conical, pointed, curved, and set close together; they form from 40 to 60 pairs in each jaw, occupying nearly the whole length of the beak, which is about twice as long as the rest of the skull; the back-fin is large and somewhat sickle-shaped; and the flippers have a nearly similar curvature, and are relatively narrow. Internally the flippers have the bones of the second and third digits well developed, but those of the others rudimentary. Dolphins, like Porpoises, associate in shoals, and display remarkable agility and grace in their movements. Their food is chiefly fish, and they are not unfrequently captured in mackerel and herring nets. In their type of colouring they recall mackerel and other fishes which swim near the surface. The mounted specimen exhibited was taken off Mevagissey, Cornwall, and purchased in 1886; in addition to this, casts of the heads of a male and a female are shown on the south wall.

Fig. 24.

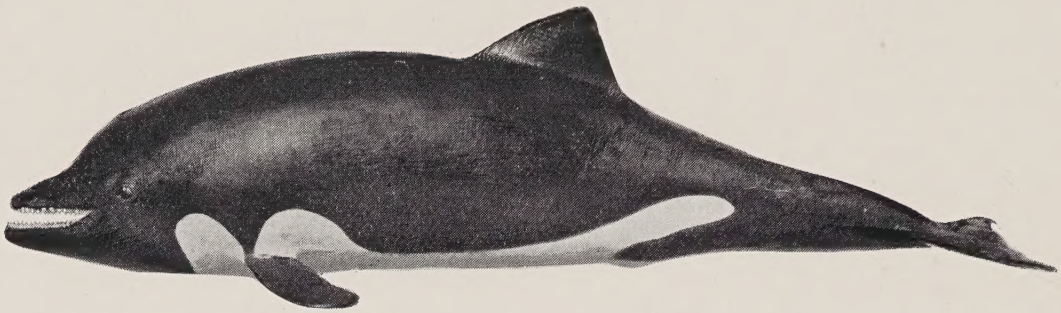


Fig. 25.

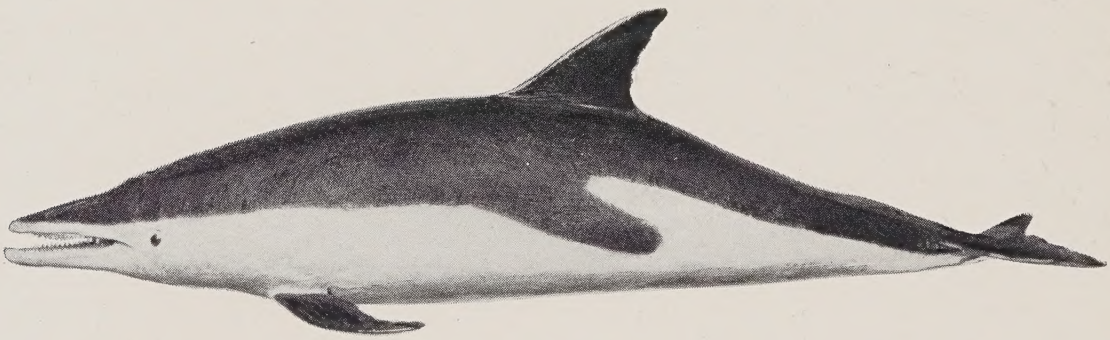


Fig. 26.

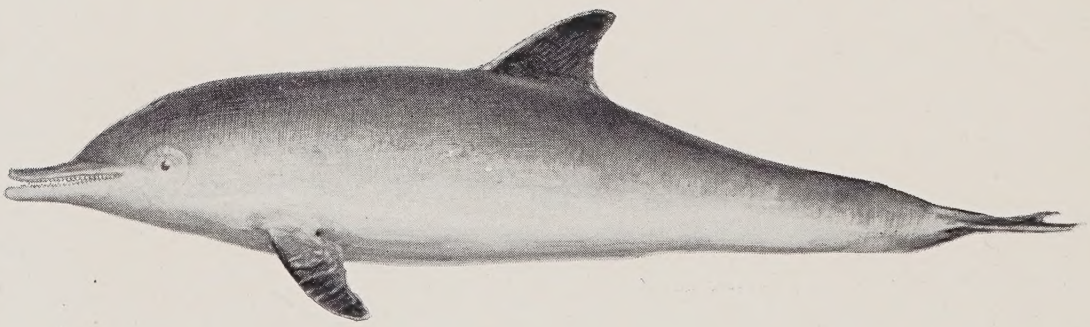


Fig. 24. Heaviside's Dolphin (*Cephalorhynchus heavisidei*).
Fig. 25. Dusky Dolphin (*Prodelphinus obscurus*).
Fig. 26. Elliot's Dolphin (*Steno perniger*).

Fig. 24 about $\frac{1}{10}$, Fig. 25 $\frac{1}{15}$, Fig. 26 $\frac{1}{19}$ natural size.

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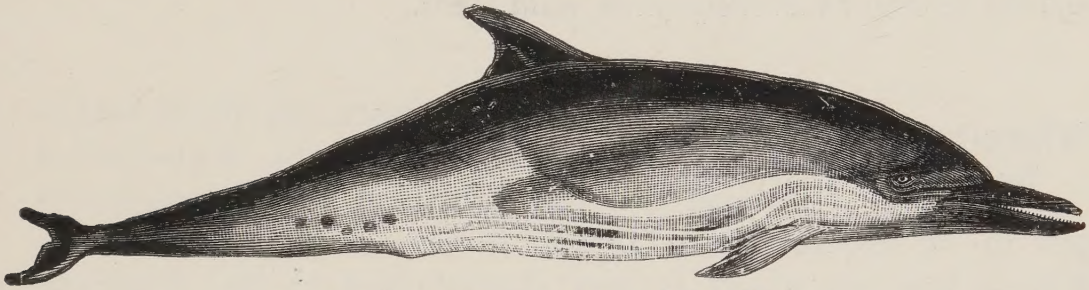
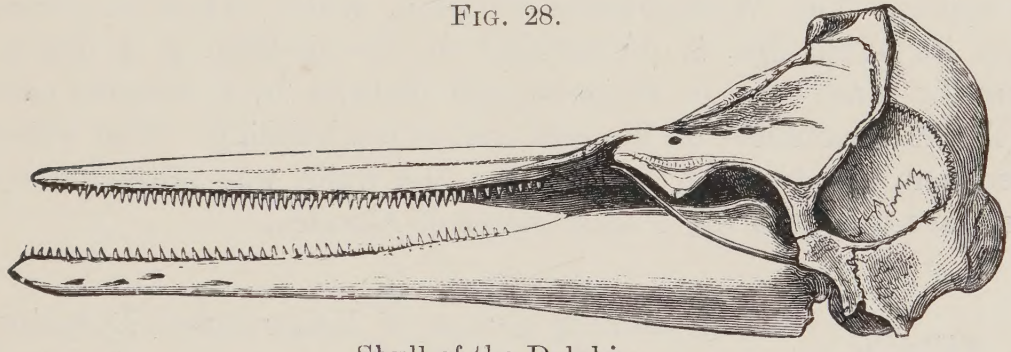
Bottle-nosed Dolphin. A near relative of the Common Dolphin, the Bottle-nosed Dolphin (*Tursiops tursio*) is readily distinguished by the reduced number of teeth (of which there are from 21 to 25 pairs in each jaw), the shape of the beak, the shorter bony union between the two branches of the lower jaw, and the absence of grooves in the sides of the palate. The geographical range of this Dolphin is very extensive, and examples are frequently captured off the British coasts. The skeleton on which the half-model exhibited is framed is that of a

FIG. 27.



The Dolphin (*Delphinus delphis*).
About $\frac{1}{18}$ natural size.

FIG. 28.



Skull of the Dolphin.
About $\frac{1}{5}$ natural size.

female captured in the Firth of Forth, and purchased in 1866. Two casts of the head are shown on the east wall, and skulls of this and other species (of which there are several) are exhibited in the wall-case at the south end of the building. An Indian species, *T. abusalam*, is shown in fig. 21, while the skull of the European one is represented in fig. 30.

Dusky Dolphin. The genus to which the Dusky Dolphin (*Prodelphinus obscurus*) belongs contains several species from the southern seas presenting close relationship with the Common and Bottle-nosed Dolphins. The beak is

somewhat variable in length, but the bony union of the two halves of the lower jaw is short (less than one-fifth the entire length of the jaw), and the teeth are very small and numerous, the number of pairs in each jaw varying from 30 to 50. The stuffed specimen exhibited (fig. 25), which is the type of the species, and came from South Africa, was presented by Captain Heaviside to the Royal College of Surgeons, whence it was transferred in 1841 to the Museum; skulls of this and other species of the genus are shown in the wall-case at the south end of the gallery, which also contains a stuffed specimen of the Malay species known as *Prodelphinus malayanus*.

White-beaked Dolphin. Two North Atlantic Cetaceans, the White-beaked Dolphin (*L. albirostris*) and the White-bellied Dolphin (*L. acutus*), both of which occasionally put in an appearance in British waters, constitute the genus *Lagenorhynchus*, which is best characterised by the numerous vertebræ (80 to 90) in the skeleton; these having short bodies and very long and slender vertical and transverse processes, or spines. The White-beaked Dolphin, which takes its name from its white lips, is represented by the skeleton of a female from the south coast of England, and likewise by a coloured cast of the head exhibited on the east wall of the building. The latter specimen, like most of the casts on the walls, was presented by the Government of the United States of America.

Elliot's Dolphin. The remaining groups of long-snouted Dolphins are chiefly distinguished from one another and the preceding genera by the characters of the teeth and skeleton—characters which cannot be given in detail in this guide-book. As an example of the first genus, we take Elliot's Dolphin (*Steno perniger*). In the somewhat extensive genus of which this species (fig. 26) is an Indian representative, the beak is of great relative length and narrowness, being very distinct from the hind part of the head, and separated by a groove from the forehead. The two halves of the lower jaw have an exceedingly long union; and the teeth, which may have either smooth or grooved crowns, vary from 20 to 35 pairs in each jaw. The present species is distinguished by the beak being more than three-fifths the length of the skull, and also by the smooth crowns of

FIG. 29.

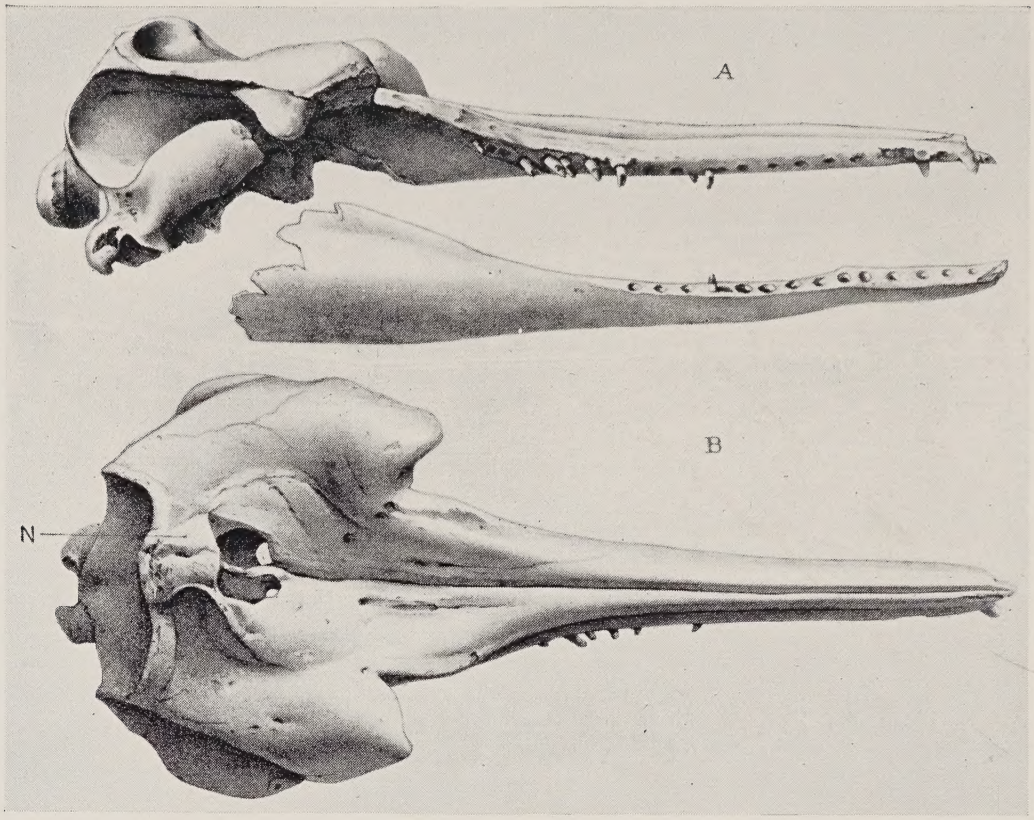


FIG. 30.

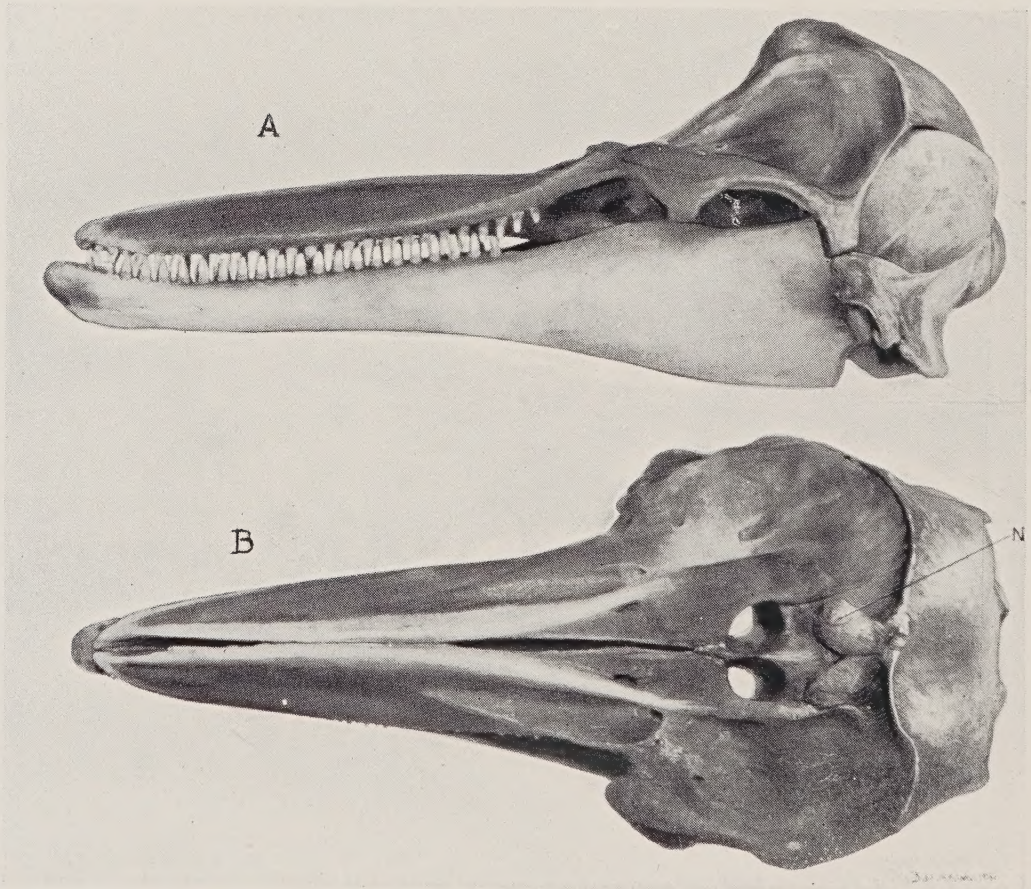


FIG. 29. Lateral (A) and Upper (B) aspects of the Skull of an Extinct Patagonian River-Dolphin (*Argyrodelphis benedeni*).

FIG. 30. Corresponding views of the Skull of the Bottle-nosed Dolphin (*Tursiops tursio*).

These figures, which are about $\frac{1}{6}$ natural size, show the small size of the nasal bones (N) characteristic of the Odontoceti generally.

[*To face page* 41.

the teeth. The specimen exhibited was presented by the Secretary of State for India in 1883.

Spotted Dolphin. Nearly allied to *Steno* is the large genus *Sotalia*, represented (in addition to skulls) in the collection by a coloured cast of an immature specimen of the Indian Spotted Dolphin (*Sotalia lentiginosa*). This cast was made from a specimen caught near Trivandrum, on the Travancore coast, and was presented by the Director of the Trivandrum Museum and Public Gardens in 1903. In the wall-case at the south end of the building is hung the type specimen of another species, *Sotalia borneënsis*, which was presented by Dr. Charles Hose. This Dolphin is mainly, if not entirely, fluviatile or estuarine in its habits.

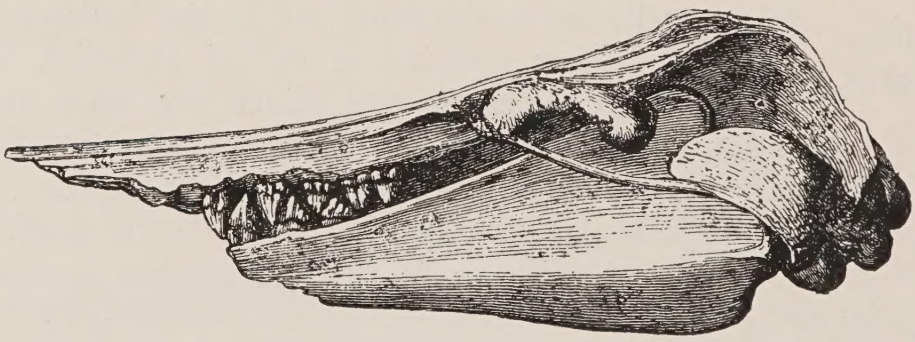
Extinct Dolphins. In the wall-case at the south end of the building are exhibited a few remains of extinct Dolphins from Tertiary formations, among which the most noteworthy is the extremity of one of the jaws of a species of the widely-spread genus *Schizodelphis;* this specimen is from the neighbourhood of Lisbon. There are also shown teeth of *Globicephalus*, *Delphinapterus*, and *Orca* from the basement bed of the Red Crag of Suffolk, which differ somewhat from those of the living representatives of the three genera, and have accordingly been assigned to extinct species.

Shark-toothed Dolphins. A number of extinct Cetaceans agree with the *Delphinidæ* in the general characters of the skull, but are broadly distinguished by their teeth being differentiated into groups, as well as by the peculiar form of those of the cheek-series. These Shark-toothed Dolphins constitute the family *Squalodontidæ*, the members of which differ from all living Cetaceans in that their hind cheek-teeth (molars) have double, in place of single, roots, and serrated edges to their crowns. The front teeth (incisors and canines) are of simple structure; but the molars, which are completely or partially double-rooted, have laterally compressed crowns, the hind edge of which is serrated, and the front edge in some instances shows less marked serrations. In the typical genus *Squalodon*, which is represented by numerous species in the Miocene Tertiary of the

Continent, the skull has a long and slender beak, but in the South American *Prosqualodon* it is much shorter. In the last-named genus the nasal bones, instead of being reduced to mere nodules, as in the *Delphinidæ*, roof over the hind part of the cavity of the nose. The *Squalodontidæ* are a more primitive type than the *Delphinidæ*.

The dental formula of the type genus *Squalodon* is now given as I. $\frac{3}{3}$, C. $\frac{1}{1}$, Pm. $\frac{9-8}{8}$, M. $\frac{3}{3-2}$. Several species of this genus, such as *Squalodon grateloupi* (fig. 31) are represented by plaster-casts of the skull, while of *Prosqualodon* an imperfect skull from the Miocene formation of Patagonia is shown. Two small species, *Microsqualodon gastaldii* and *Neosqualodon assenzæ*, have been made the types of distinct genera.

Fig. 31.



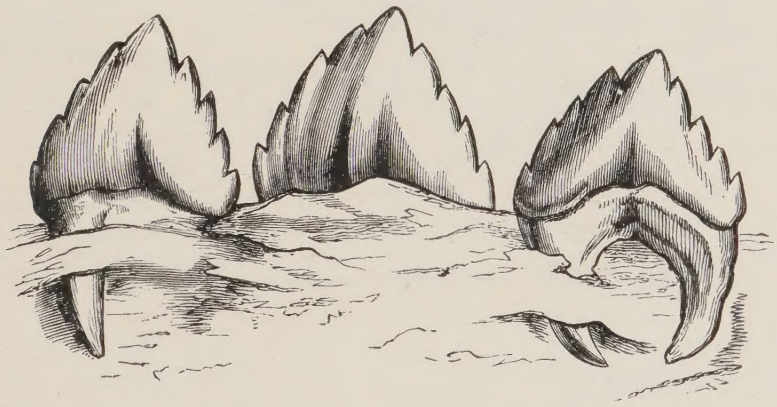
Imperfect Skull of a Shark-toothed Dolphin (*Squalodon grateloupi*). About $\frac{1}{9}$ natural size.

An imperfectly known Cetacean skull with serrated teeth, from a Tertiary formation in South Carolina, has been named *Agorophius*. This skull differs from those of *Squalodon* and modern Cetaceans in that the parietal bones occupy a long area on the roof of the skull, instead of being almost entirely excluded by the approximation of the frontal and supraoccipital bones at the vertex. This conformation suggests that the Shark-toothed Dolphins originated from a group unlike the under-mentioned Zeuglodonts.

Primitive Whales. In the Eocene deposits of North America, Europe, and Northern Africa occur remains of Whale-like creatures—mostly of large size—known as Zeuglodonts, and constituting the suborder Archæoceti and the family

Zeuglodontidæ. These Primitive Whales have long skulls, with an elongated muzzle, broad forehead, the nasal opening placed about the middle of the length and roofed over by the nasal bones, and the brain-case relatively small. The bones of the internal ear and the position of the eye are essentially Whale-like, as is also the lower jaw of the Upper Eocene species, which has a long alveolar canal, a long and loose union of its two halves in front, and a distinct coronoid process. The teeth, which are coated with enamel, are simply conical as far back as the canine or first premolar, and are separated from one another by gaps up to the second premolar; but those further back are in contact, and have either two or three roots and triangular crowns, which are much compressed and strongly serrated. The normal dental formula

Fig. 32.



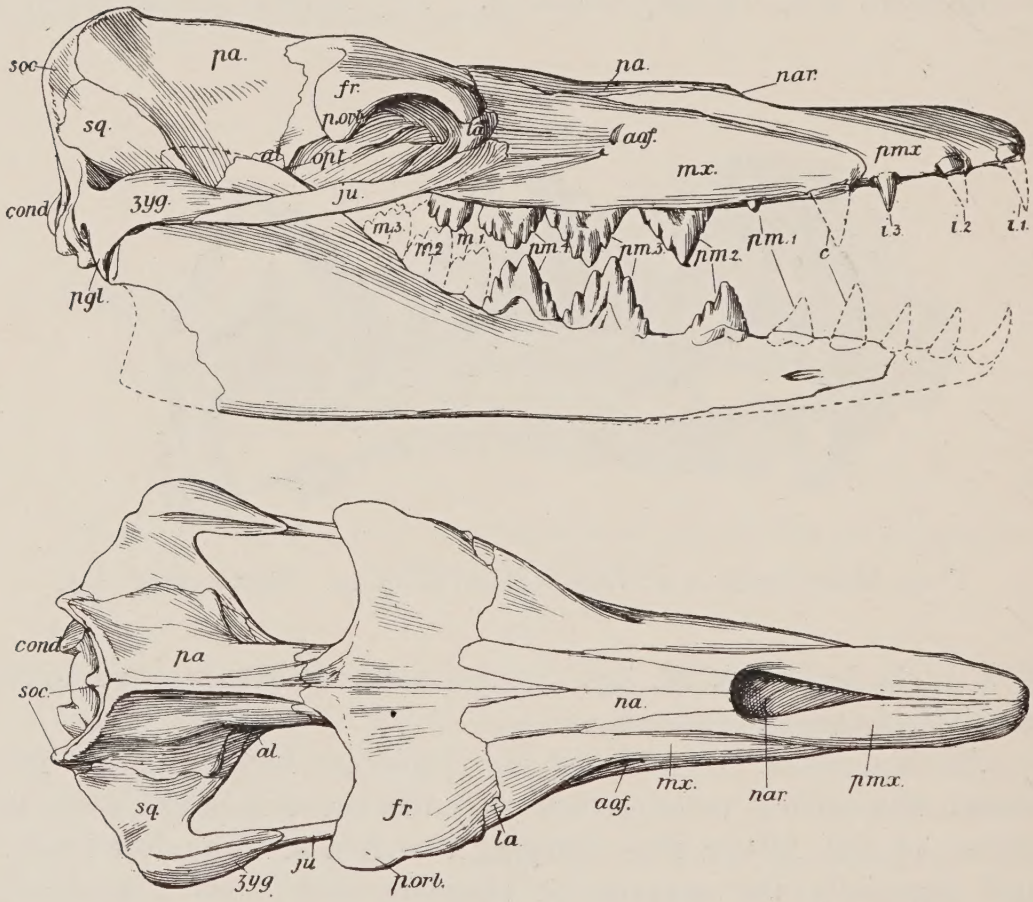
Three Molar Teeth of a Shark-toothed Dolphin. Half natural size.

is I. $\frac{3}{3}$, C. $\frac{1}{1}$, Pm. $\frac{4}{4}$, M. $\frac{3-2}{3}$, or the same as that of primitive carnivorous land Mammals.

All the seven vertebræ of the neck are free; and the first twelve rib-bearing vertebræ are very like those of land Carnivora, eleven of the fifteen ribs carrying two heads. The fore-limb—and especially the scapula or shoulder-blade—has a generally Whale-like character, the bones of the upper arm and fore-arm being distinctly flattened, and thus suggesting that the limb had the character of a flipper or paddle. The articular surfaces of the limb-bones are, however, much better developed than in modern Whales. No traces of hind-limbs have been detected. In some species the body appears to have been protected by an armour of bony plates.

The typical genus *Zeuglodon* is connected by means of certain genera like *Prozeuglodon* (fig. 33) and *Protocetus* from the Eocene formations of Egypt so closely with the primitive Eocene Carnivora known as Creodontia that there can be no hesitation in admitting the descent of the Zeuglodonts from carnivorous land-animals. The relations of Zeuglodonts to the Shark-toothed Dolphins and modern Toothed Whales are not, however, at present fully understood, although, as mentioned above, it is doubtful if any of the known genera of Primitive Whales can be regarded as directly ancestral to the Shark-toothed Dolphins.

FIG. 33.



Lateral and top views of the Skull of a Primitive Whale (*Prozeuglodon atrox*). About $\frac{1}{13}$ natural size.

pmx., premaxilla ; *nar.*, nares ; *mx.*, maxilla ; *aof.*, anterior orbital foramen ; *fr.*, frontal ; *la.*, lachrymal ; *p.orb.*, post-orbital process ; *opt.*, optic fissure ; *ju.*, jugal ; *al.*, alisphenoid ; *pa.*, parietal ; *soc.*, supra-occipital ; *sq.*, squamosal ; *zyg.*, zygoma ; *cond.*, condyle ; *pgl.*, post-glenoid process : *na.*, nasal. (After C. W. Andrews.)

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